4.9 Air Quality Impacts

This section describes the expected air quality impacts from the S.R. 108 project. Air quality impacts were evaluated using models and methodologies approved by FHWA and UDOT.

What is the air quality impacts analysis area?

Because the S.R. 108 project would be located in Davis and Weber Counties, these counties make up the impact analysis area for the air quality analysis.

4.9.1 Methodology for Evaluating Air Quality Impacts

4.9.1.1 Methodology for Evaluating CO Impacts

Impacts to CO were assessed using the CAL3QHC line source dispersion model. The CAL3QHC model considers free-flow and idling vehicle emissions in conjunction with intersection geometry, wind direction, and other meteorological factors. This model was used to calculate peak 1-hour CO concentrations near selected intersections along S.R. 108. Eight-hour CO concentrations were estimated by applying a persistence factor of 0.7 to the 1-hour concentration as recommended by EPA.

What is mixing height?

Mixing height is the height at which vertical mixing of air takes place. In unstable air, the mixing height is higher, and in stable air, the mixing height is lower. High mixing heights allow better dispersion of pollutants.

Assumptions and Parameters. Consistent with recommendations provided in UDOT's Air Quality "Hot-Spot" Manual (UDOT 2003), the critical assumptions and configuration parameters used in the CAL3QHC modeling included a 1,000-meter mixing height, low wind speed (1 meter per second), a 1-hour background CO concentration of 8.0 ppm, an 8-hour background CO concentration of 5.0 ppm, and an analysis year of 2035. In addition, the modeling assumed a very stable (Class E) atmosphere to simulate adverse wintertime air quality conditions when CO violations are more likely to occur.

The modeling evaluated 36 wind directions to ensure that the worst-case condition was considered for each receptor location (see the section below titled Sensitive Receptors). Intersection configurations and traffic movements, as well as traffic volumes and travel speeds, were provided from the traffic models. Vehicle emission rates were obtained from the Air Quality "Hot-Spot" Manual.

The CO concentrations predicted under worst-case meteorological conditions represent the highest CO levels that could be caused by vehicle emissions. This approach is consistent with the objective of the ambient air quality standards to prevent human exposure to unsafe levels of air pollution.

Sensitive Receptors. CO concentrations were estimated at locations referred to as *sensitive receptors*. In the S.R. 108 corridor, most individual exposure to CO emissions would be at locations adjacent to the roadway, including along individual segments of S.R. 108 and at intersections where people would be likely to spend more time. For each selected intersection, 15 to 18 receptors were modeled at sidewalk locations around the intersection. For each segment of S.R. 108, 10 receptors were modeled at sidewalks or other locations (for example, lawns) near the proposed alignment.

Impact Criteria. For this project, the following criteria were applied to the air quality modeling results to determine if an air quality impact would occur:

- If the modeled 1-hour CO concentration was greater than the 1-hour CO standard (35 ppm) at a receptor location, then an air quality impact would occur.
- For the 8-hour CO concentrations, an air quality impact would occur if either of the following criteria are met:
  - If the modeled 8-hour CO concentration was greater than the 8-hour CO standard (9 ppm) at a receptor location, then an air quality impact would occur.
  - For those locations with existing violations of the 8-hour standard under the No-Action Alternative, if the proposed project would increase the severity or frequency of the modeled impact compared to the No-Action Alternative, then an air quality impact would occur.

What is a sensitive receptor?

Sensitive receptors are locations where the maximum total CO concentration is likely to occur and where the general public is likely to have continuous access and exposure to vehicle emissions.

4.9.1.2 Methodology for Evaluating PM_{10} Impacts

A qualitative PM_{10} air quality impact assessment was prepared according to EPA's guidance, Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Non-attainment and Maintenance Areas (EPA 2006).

There are two categories of particulate emissions from mobile sources: primary and secondary.

- **Primary particulate emissions** are those emitted from vehicle tailpipes, brake wear, decomposition of rubber tires, and road dust stirred up by moving vehicles.
- **Secondary particulate emissions** result from chemical reactions in the atmosphere and include oxides of sulfur (SO_x) and oxides of nitrogen (NO_x) that are emitted from vehicle tailpipes as gaseous pollutants.

What are attainment, non-attainment, and maintenance areas?

An *attainment area* is an area that meets (or "attains") the NAAQS for a given pollutant. A *non-attainment area* is an area that does not meet the NAAQS for a given pollutant. A *maintenance area* is a non-attainment area that has not had a recorded violation of the NAAQS in several years and is on its way to being redesignated as an attainment area.

4.9.1.3 Methodology for Evaluating MSAT Impacts

MSATs were not quantitatively evaluated for this project because the relatively low traffic volumes on S.R. 108 would not meet FHWA's threshold of about 140,000 vehicles per day for conducting a quantitative MSAT analysis. The average annual daily traffic volumes on S.R. 108 with the proposed project are expected to be about 30,000 to 40,000 vehicles per day. However, a qualitative MSAT assessment was conducted (see Section 4.9.5, Mobile-Source Air Toxics).

4.9.2 No-Action Alternative

Under the No-Action Alternative, no improvements to S.R. 108 would be made. Under this alternative, air quality at all intersections and segments along S.R. 108 would improve over existing conditions because vehicle emission rates would be lower in 2035 than under existing conditions. Under the No-Action Alternative, the 1-hour and 8-hour NAAQS for CO would not be exceeded.

4.9.3 Minimize 4(f) Impacts Alternative

Under this alternative, S.R. 108 would be widened in a way that minimizes impacts to Section 4(f) properties.

The S.R. 108 project is consistent with WFRC's most recent Congestion Management System and was identified as a high-priority project in that document (WFRC 2004). These congestion management strategies serve to reduce air quality impacts.

The S.R. 108 project is designed to reduce congestion in a rapidly developing and high-growth area by adding general-purpose lanes on S.R. 108. Other congestion-management strategies that are designed to reduce congestion include traffic-signal coordination and intersection improvements such as dual left-turn lanes that will reduce traffic delays and improve vehicle speeds along S.R. 108.

These and other transportation demand management strategies in WFRC's Congestion Management System such as encouraging ride-sharing, growth planning, and transit improvements will all improve long-term air quality along S.R. 108.

4.9.3.1 CO Impacts

The CO impacts shown in Exhibit 4.9-1 below are operational impacts that would occur after the S.R. 108 project is completed. As shown in Exhibit 4.9-1, the modeled 1-hour CO concentrations at intersections and segments along S.R. 108 ranged from 8.9 ppm to 9.6 ppm and were below the 35-ppm NAAQS. The modeled 8-hour concentrations ranged from 5.6 ppm to 6.1 ppm and were below the 8-hour NAAQS of 9 ppm. There would be no impacts to CO under this alternative.

Exhibit 4.9-1: Modeled CO Impacts from the No-Action and Action Alternatives

Location on S.R. 108	1-Hour Concentration (ppm)				8-Hour Concentration (ppm)			
	Existing Conditions[a,c]	No-Action Alternative[a,c] (2035)	Action Alternatives[a,c] (2035)	NAAQS	Existing Conditions[b,c]	No-Action Alternative[b,c] (2035)	Action Alternatives[b,c] (2035)	NAAQS
Intersections								
300 North	9.6	8.9	9.2	35	6.1	5.6	5.8	9
1800 North	9.7	9.1	9.2	35	6.2	5.8	5.8	9
6000 South	9.4	8.8	9.1	35	6.0	5.6	5.8	9
5600 South	9.7	9.2	9.6	35	6.2	5.8	6.1	9
4800 South	9.4	9.0	9.3	35	6.0	5.7	5.9	9
4000 South	9.7	9.2	9.3	35	6.2	5.8	5.9	9
Segments								
1800 North – 2300 North	11.7	9.8	8.9	35	7.6	6.3	5.6	9
6000 South – 5600 South	10.3	9.2	9.0	35	6.6	5.8	5.7	9
5600 South – 4800 South	9.6	9.2	9.0	35	6.1	5.8	5.7	9

ppm = parts per million

[a] Includes 1-hour background concentration of 8.0 ppm.

[b] Includes 8-hour background concentration of 5.0 ppm.

[c] Highest modeled CO concentration shown for all scenarios.

4.9.3.2 PM_{10} Impacts

With the exception of the city of Ogden, Davis and Weber Counties are attainment areas for PM_{10}, so a project-level determination of whether the Minimize 4(f) Impacts Alternative would conform to the provisions of the Clean Air Act is not required. Instead, this section qualitatively describes the PM_{10} impacts from the Minimize 4(f) Impacts Alternative. Although there would be PM_{10} emissions associated with this alternative, the emissions are not expected to cause substantial impacts.

As discussed in Section 3.9, Air Quality, the Ogden urban area is currently a non-attainment area for PM_{10}, although the area is in the process of being redesignated as a maintenance area. Since the Minimize 4(f) Impacts Alternative would not be located in Ogden, there would be no PM_{10} impacts in that non-attainment area. Microscale traffic patterns in Ogden are not expected to change as a result of the Minimize 4(f) Impacts Alternative, so no impacts to the PM_{10} non-attainment area in Ogden are expected.

There are two major categories of PM_{10} emissions associated with the Minimize 4(f) Impacts Alternative: construction emissions and operational emissions.

Construction-Related PM_{10} Emissions

Construction-related PM_{10} emissions would be localized and short-term, lasting only for the duration of the construction period. Construction emissions would be minimized through good construction practices such as watering exposed surfaces, minimizing the amount of exposed and disturbed surfaces, minimizing construction equipment and vehicle speeds, and properly maintaining construction and vehicle engines.

Operational PM_{10} Emissions

Operational PM_{10} emissions, which would occur after the S.R. 108 project is completed, would have a greater range and duration than construction-related emissions.

PM_{10} monitors are generally located in or near areas with known PM_{10} problems. The nearest PM_{10} monitors to S.R. 108 are in North Salt Lake and Ogden. The North Salt Lake monitoring station is

about 350 feet from I-15 and reflects the typical PM_{10} contributions from high-volume roadways.

The ambient PM_{10} monitoring data for the North Salt Lake monitoring station show that there have been no violations of the PM_{10} standards at this monitoring station since 1999, and annual average concentrations of PM_{10} have declined since 2000. According to the Utah traffic volume data for 2000, 2001, and 2002 (UDOT 2004), average annual daily traffic volumes on I-15 near the North Salt Lake monitoring station were measured at about 99,700 vehicles per day (vpd), 115,700 vpd, and 121,600 vpd, respectively. These trends illustrate that, as annual traffic volumes increase, average annual PM_{10} concentrations have declined.

Average annual daily traffic volumes on S.R. 108 are expected to range from about 30,000 to 40,000 vehicles per day. This volume would be about 33% of the daily volume currently experienced on I-15 near the North Salt Lake monitoring station. Since the existing traffic volumes on I-15 are much higher than those expected on S.R. 108 and do not cause violations of the PM_{10} standard at the North Salt Lake monitoring station, it is unlikely that traffic volumes associated with the Minimize 4(f) Impacts Alternative would cause violations of the PM_{10} standard.

Non-tailpipe emissions include emissions from tire and brake wear and resuspended dust. Depending on the condition of the roadway, resuspended dust emissions are usually a greater source of particulates than tire and brake wear emissions. Resuspended dust emissions can be minimized through street sweeping, natural precipitation events, scavenging of dust due to high-speed traffic, and other mitigation measures.

4.9.4 West Alternative

The intersection configurations and segments of S.R. 108 under the West Alternative would be the same as those for the Minimize 4(f) Impacts Alternative, so the air quality impacts from the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative. There would be no air quality impacts under the West Alternative.

4.9.5 Mobile-Source Air Toxics (MSATs)

4.9.5.1 Project-Level MSATs

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (for example, airplanes), area sources (for example, dry cleaners), and stationary sources (for example, factories or refineries).

MSATs are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other air toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

EPA is the lead agency for administering the Clean Air Act and has some responsibilities concerning the health effects of MSATs. EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources, 66 *Federal Register* 17229 (March 29, 2001). In the rule, EPA evaluated the effects of existing and newly promulgated mobile-source control programs, including the reformulated gasoline (RFG) program, the national low-emission vehicle (NLEV) standards, the Tier 2 motor vehicle emissions standards and gasoline sulfur-control requirements, and the proposed heavy-duty engine and vehicle standards. Between 2000 and 2020, even with a 64% increase in vehicle-miles traveled (VMT), these ongoing programs should reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57% to 65% and on-highway diesel particulate matter emissions by 87%.

As a result, EPA has concluded that no additional motor vehicle emissions standards or fuel standards are necessary to further control MSATs. The agency is preparing another rule under the authority of Clean Air Act Section 202(l) that will address these issues and could make adjustments to the full list of 21 MSATs and the six primary MSATs.

Unavailable Information for Project-Specific MSAT Impact Analysis

This MSAT assessment includes a basic analysis of the likely MSAT emission impacts of the proposed project. However, available technical tools do not allow for estimates of the project-specific health impacts of the emission changes associated with the proposed alternatives. Because of these limitations, the following discussion is included in accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)) concerning incomplete or unavailable information.

Information That Is Unavailable or Incomplete. Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several activities, including emissions and dispersion modeling, estimating ambient MSAT concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and a final determination of the health impacts based on the estimated exposure. Each of these requirements has technical issues that prevent a more complete determination of the MSAT health impacts of this project.

- **Emissions Modeling.** Modeling tools to estimate MSAT emissions from motor vehicles are not sensitive to the key variables that determine MSAT emissions for highway projects. While the MOBILE 6.2 model is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 does not have the ability to predict specific emission factors for specific vehicle operating conditions at a specific location at a specific time. Because of this limitation, MOBILE 6.2 only approximates the operating speeds and levels of congestion likely to be present on the largest-scale projects and cannot adequately capture emissions from smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of validation tests based on older-technology vehicles.

These limitations limit the ability of MOBILE 6.2 to estimate MSAT emissions. As a result, MOBILE 6.2 is adequate for estimating emissions trends and performing relative analyses between alternatives for very large projects, but is not sensitive enough to capture the effects of travel changes associated with smaller projects or to estimate emissions near specific roadside locations.

- **Dispersion Modeling.** Available tools to predict how MSATs disperse in the environment are also limited. CAL3QHC and other line-source dispersion models were developed and validated more than 10 years ago for predicting worst-case CO concentrations to determine compliance with the NAAQS. The performance of dispersion models such as CAL3QHC is more accurate for estimating the maximum concentrations that can occur at a given time and location. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific locations throughout an urban area to assess potential health risks. The National Cooperative Highway Research Program (NCHRP) is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This research also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, there is also a lack of site-specific monitoring data for use in establishing project-specific MSAT background concentrations.
- **Exposure Levels and Health Effects.** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, limitations in current techniques for exposure assessment and risk analysis preclude meaningful conclusions about project-specific health impacts associated with MSATs. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are further compounded for 70-year cancer assessments, especially because unsupportable assumptions would have to be made concerning changes in travel patterns and vehicle technology (which affects emissions rates) over a

70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity for the MSATs and translating occupational exposure data to the general population. Because of these uncertainties, any estimated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. The conclusions resulting from such assessments would not be useful to decision-makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs. Research into the health impacts of MSATs is ongoing. For different emission types, there are a number of studies indicating statistical associations with adverse health outcomes through epidemiological studies (frequently based on emission levels found in occupational settings) or that demonstrate adverse health outcomes in laboratory animals when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information represents EPA's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- **Acrolein's** carcinogenicity cannot be determined because the existing data are inadequate for an assessment of human

carcinogenic potential for either the oral or inhalation route of exposure.

- **Formaldehyde** is a probable human carcinogen based on limited evidence in humans and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this EIS is the combination of diesel particulate matter and diesel exhaust organic gases.

  Diesel exhaust is also associated with chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a nonprofit organization funded by EPA, FHWA, and industry, has undertaken a series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile-source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems. Much of this research is not specific to MSATs, but instead surveys the full spectrum of criteria and other pollutants. FHWA cannot evaluate the validity of these studies nor provide information that would be useful to alleviate the uncertainties associated with the health effects of MSATs.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of Impacts Based on Theoretical Approaches or Research Methods Generally Accepted in the Scientific Community. Because of the uncertainties discussed above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level for the S.R. 108 project. While some analytical tools do allow for reasonable predictions of relative emissions changes between alternatives for larger projects, the MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with sufficient accuracy to be useful in estimating health impacts. Therefore, the relevance of the unavailable or incomplete information leads to the conclusion that it is not possible to make a determination of whether any of the alternatives would have significant adverse impacts on the human environment.

Therefore, the S.R. 108 project could result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

4.9.5.2 MSAT Impacts (Action Alternatives)

For the action alternatives, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are similar for each alternative. The VMT estimated for each of the action alternatives (about 96 million VMT per year) is higher than for the No-Action Alternative (about 65 million VMT per year) because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. The increase in VMT over the No-Action Alternative would lead to higher MSAT emissions along S.R. 108 (primarily during peak traffic hours in the morning and evening) along with a corresponding decrease in MSAT emissions along parallel routes. A comparison of regional VMT shows no appreciable differences between the No-Action and action alternatives. The emission increases along S.R. 108 would be offset by lower MSAT emission rates due to increased speeds. According to EPA's

MOBILE 6.2 emissions model, emissions of all priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emission decreases will offset VMT-related emission increases cannot be reliably projected due to the inherent deficiencies of existing technical models.

Because the estimated VMT under each of the action alternatives are nearly the same, there would be no appreciable difference in overall MSAT emissions between the two alternatives. In addition, vehicle emissions would likely be lower in the future as a result of EPA's national control programs that are expected to reduce MSAT emissions by 57% to 87% between 2000 and 2020. Local conditions along S.R. 108 might differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures, but the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes resulting from either of the action alternatives could move some traffic closer to nearby homes, schools, and businesses, so under each alternative there might be localized areas where ambient concentrations of MSATs could be higher than under the No-Action Alternative. However, as discussed above, the magnitude and the duration of these potential increases compared to the No-Action Alternative cannot be accurately quantified due to the limitations of current models. Therefore, under either of the action alternatives, the localized level of MSAT emissions could be higher relative to the No-Action Alternative, but this could be offset due to increases in vehicle speeds and reduced congestion along the roadway. Also, MSATs will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with vehicle fleet turnover, will, over time, result in substantial MSAT emission reductions that, in almost all cases, will cause region-wide MSAT levels to be substantially lower than they are under existing conditions.

4.9.6 Mitigation Measures for Impacts to Air Quality

Because there were no CO impacts associated with either alternative, no mitigation for impacts to CO is required.

For PM_{10}, several mitigation measures will be implemented as part of the proposed project. These measures will include minimizing construction emissions through best management practices and maintaining construction equipment engines.

4.10 Noise Impacts

This section describes noise impacts associated with the S.R. 108 project. Traffic noise impacts were evaluated using noise models and methodologies approved by FHWA and UDOT. Noise impacts were identified at residential and commercial locations within about 500 feet of the proposed alignments. Where appropriate, noise walls or other abatement measures were evaluated to mitigate noise impacts, and recommendations were made for considering whether to construct noise walls.

What is the noise impact analysis area?

The impact analysis area for the noise analysis is the land adjacent to the proposed alignments that could be affected by an increase in noise from construction and operation of the proposed alternatives.

4.10.1 Methodology for Evaluating Noise Impacts

4.10.1.1 Traffic Noise Impact Methodology

The following methods were used to assess traffic noise impacts associated with the proposed project:

- Field surveys and aerial photographs were used to identify existing activities, developed lands, and undeveloped lands for which development is planned, designed, or programmed and that could be affected by noise from the S.R. 108 alternatives.
- Short-term (15-minute) sound-level measurements typical of existing conditions at residences, parks, and churches (as described in Section 3.10.3, Existing Noise Levels) were taken throughout the project area and were used to characterize the existing noise environment.
- Project-related traffic noise levels were predicted using the FHWA Traffic Noise Model, Version 2.5 (February 2004).
- Project-related traffic noise impacts were identified using the criteria specified in UDOT's Noise Policy.
- Mitigation measures for reducing noise impacts were evaluated using UDOT's guidelines for determining feasibility, reasonableness, and cost-effectiveness.

What is noise?

Noise is defined as unwanted sound. This EIS uses the A-weighted decibel scale (dBA) for measuring noise levels.

4.10.1.2 The Traffic Noise Model

Traffic noise levels were modeled using the FHWA Traffic Noise Model (TNM), Version 2.5. TNM estimates acoustic intensity at receiver locations based on the level of sound energy generated from a series of straight-line roadway segments. The effects of factors that shield residences from traffic noise, such as existing structures, vegetation, or terrain, can be included in the model to provide a higher level of detail and accuracy.

Because the S.R. 108 improvements would extend over about 9.5 miles, the project corridor was divided into nine segments to facilitate the noise modeling (see Exhibit 2.1-4: Corridor Segments). In addition, the analysis focused on areas with residential developments where noise walls might be warranted.

Noise levels were modeled to reflect the expected traffic conditions in 2035 after the project is completed. Under either of the action alternatives, the level of service along S.R. 108 would range from LOS B to LOS E. In those segments where the level of service was LOS D or E, LOS C was used for volumes and vehicle speeds in order to maximize noise levels and generate a worst-case scenario. As a result, the modeled noise levels were nearly the same for both alternatives.

Under the action alternatives, some residences along S.R. 108 would be subject to residential relocations. For the noise analysis, the number of affected residences does not include any residences that are subject to potential or confirmed relocations.

4.10.2 No-Action Alternative

Land uses along S.R. 108 are a mix of residential, commercial, and agricultural uses on both sides of the existing alignment. Most residences and businesses have direct access to S.R. 108.

Under the No-Action Alternative, no improvements to S.R. 108 would be made, so no noise impacts would occur due to the project. Under the No-Action Alternative, all nine segments of S.R. 108 would operate at LOS F with very slow traffic speeds (about 13 mph). As a result of increased traffic operating at slower speeds, noise levels along S.R. 108 would increase by about 1 dBA over existing conditions, which would not be detectable by humans. Under the No-Action Alternative, the residential noise-abatement criterion would be approached or exceeded at 347 residences (see Exhibit 4.10-1 through Exhibit 4.10-9, Modeled Noise Levels, beginning on page 4-87).

What is the residential noise-abatement criterion?

The residential noise-abatement criterion is the noise level (66 dBA) at which UDOT would consider building noise walls that would abate, or reduce, noise impacts from the project on residences near S.R. 108.

4.10.3 Minimize 4(f) Impacts Alternative

Under this alternative, S.R. 108 would be widened to minimize impacts to Section 4(f) properties. The impact analysis area and receptor locations for this alternative are shown in Exhibit 4.10-10 through Exhibit 4.10-18, Noise Receptor Locations, beginning on page 4-97. All churches, public parks, playgrounds, and recreation facilities are located well over 500 feet from S.R. 108 and, in most instances, the noise from S.R. 108 is screened by several rows of intervening residences or other buildings. At such distances there

would be no discernible increase in noise levels due to the project improvements on S.R. 108. As discussed in more detail below, project-related improvements would increase existing noise levels by about 1 dBA to 2 dBA at churches, parks, playgrounds, and recreational facilities nearest the road. Since all of the public parks and playgrounds are located well away from the road, noise impacts due to the project would not be discernible to humans. In addition, the parks and playgrounds are active recreation areas where very low noise levels are not an important feature of the facility.

The goal of the noise analysis was to determine if the predicted noise levels under this alternative would approach or exceed the applicable noise-abatement criterion (66 dBA for residential locations) or would result in a 10-dBA increase over existing noise levels (which is considered a substantial exceedance according to UDOT criteria). Under this alternative, the residential noise-abatement criterion would be approached or exceeded at about 300 residences.

4.10.3.1 Segment 1 (Antelope Drive to 700 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 1 are shown in Exhibit 4.10-1: Modeled Noise Levels (dBA): Segment 1 – Antelope Drive to 700 South on page 4-87. Under existing conditions, the residential noise-abatement criterion is exceeded at 13 noise receptors representing about 34 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 1 would increase by 1 dBA to 2 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at eight receptor locations representing about 19 residences.

4.10.3.2 Segment 2 (700 South to 300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 2 are shown in Exhibit 4.10-2: Modeled Noise Levels (dBA): Segment 2 – 700 South to 300 North on page 4-88. Under existing conditions, the residential noise-abatement criterion is exceeded at 13 noise receptors representing about 50 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 2 would increase by 1 dBA to 2 dBA at residences near the

roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 10 receptor locations representing about 39 residences.

4.10.3.3 Segment 3 (300 North to 1300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 3 are shown in Exhibit 4.10-3: Modeled Noise Levels (dBA): Segment 3 – 300 North to 1300 North on page 4-89. Under existing conditions, the residential noise-abatement criterion is exceeded at 20 noise receptors representing about 53 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 3 would increase by 1 dBA to 2 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 12 receptor locations representing about 28 residences.

4.10.3.4 Segment 4 (1300 North to 2300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 4 are shown in Exhibit 4.10-4: Modeled Noise Levels (dBA): Segment 4 – 1300 North to 2300 North on page 4-90. Under existing conditions, the residential noise-abatement criterion is exceeded at 10 noise receptors representing about 29 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 4 would decrease by 1 dBA at one location, stay the same, or increase by 1 dBA to 2 dBA. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at six receptor locations representing about 18 residences.

4.10.3.5 Segment 5 (2300 North to 5600 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 5 are shown in Exhibit 4.10-5: Modeled Noise Levels (dBA): Segment 5 – 2300 North to 5600 South on page 4-91. Under existing conditions, the residential noise-abatement criterion is exceeded at 16 noise receptors representing about 42 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 5 would decrease by 1 dBA at some locations, stay the

same, or increase by 1 dBA. The residential noise-abatement criterion would be approached or exceeded at 16 receptor locations representing about 42 residences (there would be no potential or confirmed residential relocations in Segment 5).

4.10.3.6 Segment 6 (5600 South to 4800 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 6 are shown in Exhibit 4.10-6: Modeled Noise Levels (dBA): Segment 6 – 5600 South to 4800 South on page 4-92. Under existing conditions, the residential noise-abatement criterion is exceeded at 15 noise receptors representing about 53 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 6 would increase by 1 dBA to 3 dBA at residences near the roadway. The residential noise-abatement criterion would be approached or exceeded at 16 receptor locations representing about 56 residences (there would be no potential or confirmed residential relocations in Segment 6).

4.10.3.7 Segment 7 (4800 South to 4000 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 7 are shown in Exhibit 4.10-7: Modeled Noise Levels (dBA): Segment 7 – 4800 South to 4000 South on page 4-93. Under existing conditions, the residential noise-abatement criterion is exceeded at 10 noise receptors representing about 26 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 7 would increase by 1 dBA to 4 dBA at residences near the roadway. The residential noise-abatement criterion would be approached or exceeded at 14 receptor locations representing about 33 residences (there would be no potential or confirmed residential relocations in Segment 7).

4.10.3.8 Segment 8 (4000 South to 3600 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 8 are shown in Exhibit 4.10-8: Modeled Noise Levels (dBA): Segment 8 – 4000 South to 3600 South on page 4-94. Under existing conditions, the residential noise-abatement criterion is exceeded at 16 noise receptors representing about 26 residences.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 8 would increase by 2 dBA to 6 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 15 receptor locations representing about 30 residences.

4.10.3.9 Segment 9 (3600 South to 1900 West)

Modeled noise levels and project-related impacts at noise receptors in Segment 9 are shown in Exhibit 4.10-9: Modeled Noise Levels (dBA): Segment 9 – 3600 South to 1900 West on page 4-96. Under existing conditions, the residential noise-abatement criterion is exceeded at nine noise receptors representing about four residences and 20 townhomes next to Midland Drive.

Under the Minimize 4(f) Impacts Alternative, noise levels in Segment 9 would increase by 4 dBA to 7 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 10 receptor locations representing about four to five residences and 20 or more townhomes, some of which are under construction.

4.10.4 West Alternative

The absolute noise impact under the West Alternative (that is, the increase in noise levels over existing conditions) would be generally the same as that under the Minimize 4(f) Impacts Alternative (an increase of 1 dBA to 6 dBA over existing conditions). The biggest difference between the two action alternatives is the number of residences that would be affected after potential and confirmed residential relocations are excluded in each segment. Under this alternative, the residential noise-abatement criterion would be approached or exceeded at about 250 residences.

4.10.4.1 Segment 1 (Antelope Drive to 700 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 1 are shown in Exhibit 4.10-1: Modeled Noise Levels (dBA): Segment 1 – Antelope Drive to 700 South on page 4-87. Under existing conditions, the residential noise-abatement criterion is exceeded at 13 noise receptors representing about 34 residences.

Under the West Alternative, noise levels in Segment 1 would increase by 1 dBA to 2 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at eight receptor locations representing about 19 residences (the same as for the Minimize 4(f) Impacts Alternative).

4.10.4.2 Segment 2 (700 South to 300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 2 are shown in Exhibit 4.10-2: Modeled Noise Levels (dBA): Segment 2 – 700 South to 300 North on page 4-88. Under existing conditions, the residential noise-abatement criterion is exceeded at 13 noise receptors representing about 50 residences.

Under the West Alternative, noise levels in Segment 2 would increase by 1 dBA to 2 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at six receptor locations representing about 19 residences.

4.10.4.3 Segment 3 (300 North to 1300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 3 are shown in Exhibit 4.10-3: Modeled Noise Levels (dBA): Segment 3 – 300 North to 1300 North on page 4-89. Under existing conditions, the residential noise-abatement criterion is exceeded at 20 noise receptors representing about 53 residences.

Under the West Alternative, noise levels in Segment 3 would increase by 1 dBA to 7 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at nine receptor locations representing about 22 residences.

4.10.4.4 Segment 4 (1300 North to 2300 North)

Modeled noise levels and project-related impacts at noise receptors in Segment 4 are shown in Exhibit 4.10-4: Modeled Noise Levels (dBA): Segment 4 – 1300 North to 2300 North on page 4-90. Under existing conditions, the residential noise-abatement criterion is exceeded at 10 noise receptors representing about 29 residences.

Under the West Alternative, noise levels in Segment 4 would decrease by 1 dBA at some locations, stay the same, or increase by 1 dBA to 2 dBA. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at six receptor locations representing about 18 residences.

4.10.4.5 Segment 5 (2300 North to 5600 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 5 are shown in Exhibit 4.10-5: Modeled Noise Levels (dBA): Segment 5 – 2300 North to 5600 South on page 4-91. Under existing conditions, the residential noise-abatement criterion is exceeded at 16 noise receptors representing about 42 residences.

Under the West Alternative, noise levels in Segment 5 would decrease by 1 dBA at some locations, stay the same, or increase by 1 dBA to 2 dBA. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 15 receptor locations representing about 38 residences.

4.10.4.6 Segment 6 (5600 South to 4800 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 6 are shown in Exhibit 4.10-6: Modeled Noise Levels (dBA): Segment 6 – 5600 South to 4800 South on page 4-92. Under existing conditions, the residential noise-abatement criterion is exceeded at 15 noise receptors representing about 53 residences.

Under the West Alternative, noise levels in Segment 6 would increase by 1 dBA to 3 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 11 receptor locations representing about 39 residences.

4.10.4.7 Segment 7 (4800 South to 4000 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 7 are shown in Exhibit 4.10-7: Modeled Noise Levels (dBA): Segment 7 – 4800 South to 4000 South on page 4-93. Under existing conditions, the residential noise-abatement criterion is exceeded at 10 noise receptors representing about 26 residences.

Under the West Alternative, noise levels in Segment 7 would increase by 1 dBA to 3 dBA at residences near the roadway. The residential noise-abatement criterion would be approached or exceeded at 12 receptor locations representing about 29 residences (there would be no potential or confirmed residential relocations in Segment 7).

4.10.4.8 Segment 8 (4000 South to 3600 South)

Modeled noise levels and project-related impacts at noise receptors in Segment 8 are shown in Exhibit 4.10-8: Modeled Noise Levels (dBA): Segment 8 – 4000 South to 3600 South on page 4-94. Under existing conditions, the residential noise-abatement criterion is exceeded at 16 noise receptors representing about 26 residences.

Under the West Alternative, noise levels in Segment 8 would increase by 2 dBA to 6 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 14 receptor locations representing about 28 residences.

4.10.4.9 Segment 9 (3600 South to 1900 West)

Modeled noise levels and project-related impacts at noise receptors in Segment 9 are shown in Exhibit 4.10-9: Modeled Noise Levels (dBA): Segment 9 – 3600 South to 1900 West on page 4-96. Under existing conditions, the residential noise-abatement criterion is exceeded at nine noise receptors representing about four residences and 20 townhomes next to Midland Drive.

Under the West Alternative, noise levels in Segment 9 would increase by 4 dBA to 7 dBA at residences near the roadway. Excluding potential or confirmed relocations, the residential noise-abatement criterion would be approached or exceeded at 10 receptor locations representing about four to five residences and 20 or more townhomes, some of which are under construction.

4.10.5 Mitigation Measures for Noise Impacts

4.10.5.1 UDOT's Noise-Abatement Criteria

This section discusses methods for abating, or reducing, the traffic noise impacts from S.R. 108 that were identified in the previous sections.

According to UDOT's Noise-Abatement Policy (UDOT 08A2-1), noise abatement will be considered for roadway construction projects where noise impacts are identified. Both of the S.R. 108 action alternatives would add additional lanes of travel, so noise-abatement measures can be considered. The goal of noise abatement is to substantially reduce noise levels, although this noise reduction might or might not result in noise levels that are below the applicable noise-abatement criterion (66 dBA for residential locations).

The two relevant criteria to consider when identifying and evaluating noise-abatement measures are feasibility and reasonableness. Noise abatement will be provided by UDOT only if the noise-abatement measures are *both* feasible and reasonable.

Feasibility

Noise-abatement feasibility deals primarily with construction and engineering considerations. (For example, can noise be substantially reduced at a specific location? Is noise abatement limited by factors such as topography, access requirements, the presence of local cross streets, or other noise sources in the area?)

Under the UDOT noise policy, a noise wall (or other abatement measure) that will not reduce noise by at least 5 dBA for at least 75% of the first-row residences (those closest to the roadway) is not considered feasible.

Reasonableness

Reasonableness is a more subjective criterion than feasibility. Reasonableness suggests that common sense and good judgment have been applied in arriving at a decision to recommend a noise-abatement measure. (For example, does the noise-abatement measure satisfy the cost criterion established by the noise policy?) As a result, a noise wall could be feasible (that is, provide the minimum required

5 dBA of noise reduction at a majority of the first-row residences), but not be reasonable (for example, by not meeting UDOT's cost criterion).

4.10.5.2 Feasibility and Reasonableness Factors

UDOT considers the following factors, among others, when determining the feasibility and reasonableness of noise-abatement measures:

- **Noise-Abatement Benefits.** Reasonable efforts will be made to substantially reduce noise. UDOT defines a substantial noise reduction as a 10-dBA noise reduction at one first-row receiver adjacent to the proposed alignment. Under the UDOT noise policy, noise walls are considered feasible if they reduce noise by at least 5 dBA at the majority of first-row receivers.
- **Land Use and Zoning.** The existing zoning and land uses adjacent to the transportation facility will be reviewed. In general, noise walls are not consistent with commercial or industrial zoning because businesses usually attract customers by being visible to drivers on the road.
- **Engineering, Safety, and Maintenance.** Engineering, safety, and maintenance issues must be considered to determine the constructability of a noise-abatement measure. If any of these issues are substantial enough to preclude good safety and maintenance practices, then the noise wall might not be feasible.
- **Cost of Abatement.** In residential areas, all residences affected by the proposed project must be considered in determining a noise wall's cost effectiveness. Under UDOT policy, a benefiting residence is one at which noise is reduced by at least 5 dBA as a result of the noise wall. The maximum cost used to determine the reasonableness of a noise-abatement measure is $30,000 per benefiting receiver based on a noise wall cost of $20 per square foot.
- **Public Involvement and Balloting.** The UDOT Project Manager, Public Involvement Coordinator, and Environmental Engineer/Manager will decide on the appropriate level of public involvement. The purpose of the public involvement process is to ensure that the concerns of the affected communities are

known and that every effort is made to provide noise abatement to an affected community.

- **Abatement Design.** A noise-abatement measure must be designed with the following considerations in mind: (1) good design practice, (2) optimal performance, and (3) current highway safety technology. UDOT will consider aesthetics treatment, graffiti deterrence, and landscaping where appropriate in relation to design standard specifications, cost efficiency, maintenance, and the regulations of local municipalities.

Once a noise wall has been determined to be feasible, UDOT will determine whether its construction is reasonable by thoroughly considering the range of factors described above, including the cost-effectiveness of the measure. UDOT will construct noise walls only if they have been determined to be both feasible and reasonable. The decision to recommend or not recommend a noise wall is the responsibility of the UDOT Environmental Engineer/Manager with concurrence from the Project Manager and the Preconstruction Engineer. For projects with federal involvement, FHWA will have final approval for noise-abatement measures.

4.10.5.3 Noise-Abatement Methodology

The effectiveness of noise walls is generally limited to areas within about 500 feet of the proposed right-of-way. Beyond this distance, noise walls do not effectively reduce noise levels at individual residences. In addition, noise walls are most effective where they are continuous and block a number of individual residences. The short spacing between individual residences and driveways, as well as the need to maintain access along S.R. 108, make noise walls infeasible in Segments 1 through 7 of S.R. 108.

Noise walls were considered for two mobile-home parks in Segment 8 and for townhomes adjacent to the alignment in Segment 9. Four noise walls were considered adjacent to Karol's Mobile Estates and the Country Meadows Estates, and two noise walls were constructed adjacent to the townhomes in Segment 9. The results of the evaluation are summarized below. Beginning on page 4-106, Exhibit 4.10-19 through Exhibit 4.10-24, Noise Mitigation Analysis, show the abatement evaluation for each noise wall that was considered. The locations of potential noise walls are shown in Exhibit 4.10-17: Noise Receptor Locations – Segment 8, R8-1 to R8-41 and Exhibit 4.10-18: Noise Receptor Locations – Segment 9, R9-1 to R9-13 on pages 4-104 and 4-105.

For each noise wall considered, the feasibility and reasonableness of wall heights between 6 feet and 18 feet were evaluated to determine the following:

- The number of noise-impacted residences that would benefit from the noise wall (those at which noise would be reduced by at least 5 dBA)
- The maximum noise level reduction from the noise wall (the degree to which a noise wall could reduce noise by at least 10 dBA as required by UDOT's Noise Policy)
- Whether at least 75% of first-row residences would benefit from the noise wall
- The cost-effectiveness of the noise wall (cost per benefiting residence)
- An overall determination of whether the noise wall is both feasible and reasonable (cost-effective)

4.10.5.4 Noise-Abatement Measures

Segment 8 (4000 South to 3600 South)

Four noise walls were considered in Segment 8, and all four were considered feasible and reasonable. Residents who are adjacent to the proposed noise walls will be able to vote on whether they want the noise walls to be built. If residents are in favor of noise walls, they will be constructed.

- **Wall 1** (about 550 feet long) was located on the southeast side of Karol's Mobile Estates. A noise wall 16 feet high at this location would reduce noise by 4 dBA to 12 dBA at the majority of first-row residences and would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-19: Noise Mitigation Analysis – Wall 1 on page 4-106.
- **Wall 2** (about 300 feet long) was located on the northeast side of Karol's Mobile Estates. A noise wall between 12 feet and 18 feet high would reduce noise by up to 6 dBA at the majority of first-row residences. A noise wall in this location would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-20: Noise Mitigation Analysis – Wall 2 on page 4-107.
- **Wall 3** (about 400 feet long) was located on the south end of the Country Meadows Estates. A noise wall between 12 feet and 18 feet high would reduce noise by 9 dBA to 12 dBA at first-row residences and would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-21: Noise Mitigation Analysis – Wall 3 on page 4-108.
- **Wall 4** (about 425 feet long) was located on the north end of the Country Meadows Estates. A noise wall between 12 feet and 18 feet high would reduce noise by 7 dBA to 13 dBA at first-row residences and would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-22: Noise Mitigation Analysis – Wall 4 on page 4-109.

Segment 9 (3600 South to 1900 West)

Two noise walls were considered in Segment 9, and both were considered feasible and reasonable. Residents who are adjacent to the proposed noise walls will be able to vote on whether they want the noise walls to be built. If residents are in favor of noise walls, they will be constructed.

- **Wall 5** (about 360 feet long) was located adjacent to the relatively new townhome development on the south side of the alignment. A noise wall 8 feet high at this location would reduce noise by about 5 dBA to 9 dBA at the majority of first-row residences and would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-23: Noise Mitigation Analysis – Wall 5 on page 4-110.
- **Wall 6** (about 950 feet long) was located on the south side of the alignment adjacent to the townhome development. Similar to Wall 5 described above, a noise wall 8 feet high would reduce noise by 6 dBA to 10 dBA at the majority of first-row residences. A noise wall in this location would be feasible and reasonable according to UDOT's noise-abatement criteria. For more information, see Exhibit 4.10-24: Noise Mitigation Analysis – Wall 6 on page 4-111.

Exhibit 4.10-1: Modeled Noise Levels (dBA): Segment 1 – Antelope Drive to 700 South

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R1-1	1	68	Yes	70	2	Yes	70	2	Yes
R1-2	5	59	No	60	1	No	60	1	No
R1-3	5	60	No	61	1	No	61	1	No
R1-4	5	56	No	57	1	No	56	0	No
R1-5	5	57	No	58	1	No	57	0	No
R1-6	2	68	Yes	69	1	Yes	69	1	Yes
R1-7	2	69	Yes	70	1	Yes	70	1	Yes
R1-8	2	57	No	57	0	No	57	0	No
R1-9	2	57	No	59	2	No	59	2	No
R1-10[a]	2	63	No	64	1	No	64	1	No
R1-11	3	59	No	59	0	No	59	0	No
R1-12	2	57	No	59	2	No	59	2	No
R1-13	2	63	No	63	0	No	63	0	No
R1-14	3	68	Yes	69	1	Yes	69	1	Yes
R1-15[a]	4	67	Yes	68	1	Yes	68	1	Yes
R1-16	3	68	Yes	69	1	Yes	69	1	Yes
R1-17[a]	3	67	Yes	68	1	Yes	68	1	Yes
R1-18	2	69	Yes	69	0	Yes	69	0	Yes
R1-19[a]	2	66	Yes	68	2	Yes	68	2	Yes
R1-20	3	68	Yes	69	1	Yes	69	1	Yes
R1-21[a]	3	67	Yes	68	1	Yes	68	1	Yes
R1-22[a]	3	67	Yes	68	1	Yes	68	1	Yes
R1-23	3	68	Yes	69	1	Yes	69	1	Yes
R1-24	3	64	No	65	1	No	65	1	No
R1-25	3	63	No	63	0	No	63	0	No

See Exhibit 4.10-10: Noise Receptor Locations – Segment 1, R1-1 to R1-25 on page 4-97 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

Exhibit 4.10-2: Modeled Noise Levels (dBA): Segment 2 – 700 South to 300 North

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R2-1[b]	3	71	Yes	72	1	Yes	77	6	Yes
R2-2[b]	6	71	Yes	72	1	Yes	76	5	Yes
R2-3[b]	6	71	Yes	72	1	Yes	77	6	Yes
R2-4[b]	5	70	Yes	71	1	Yes	74	4	Yes
R2-5[a]	5	71	Yes	75	4	Yes	78	7	Yes
R2-6	3	72	Yes	72	0	Yes	72	0	Yes
R2-7	4	59	No	61	2	No	61	2	No
R2-8	3	55	No	56	1	No	56	1	No
R2-9	3	59	No	61	2	No	61	2	No
R2-10	3	56	No	57	1	No	57	1	No
R2-11[a]	3	71	Yes	76	5	Yes	76	5	Yes
R2-12	4	61	No	62	1	No	62	1	No
R2-13	3	54	No	55	1	No	55	1	No
R2-14	3	73	Yes	73	0	Yes	73	0	Yes
R2-15[a]	3	71	Yes	77	6	Yes	77	6	Yes
R2-16[a]	3	71	Yes	77	6	Yes	77	6	Yes
R2-17	3	65	No	66	1	Yes	66	1	Yes
R2-18	3	55	No	56	1	No	56	1	No
R2-19	3	68	Yes	69	1	Yes	69	1	Yes
R2-20	3	58	No	60	2	No	60	2	No
R2-21	3	56	No	58	2	No	58	2	No
R2-22	3	71	Yes	72	1	Yes	72	1	Yes
R2-23	4	60	No	61	1	No	61	1	No
R2-24	3	61	No	62	1	No	62	1	No
R2-25	4	70	Yes	70	0	Yes	70	0	Yes
R2-26	3	57	No	59	2	No	59	2	No
R2-27	3	53	No	54	1	No	54	1	No
R2-28	2	61	No	62	1	No	62	1	No
R2-29	2	56	No	58	2	No	58	2	No

See Exhibit 4.10-11: Noise Receptor Locations – Segment 2, R2-1 to R2-29 on page 4-98 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

[b] Potential or confirmed relocations under the West Alternative.

Exhibit 4.10-3: Modeled Noise Levels (dBA): Segment 3 – 300 North to 1300 North

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R3-1[a]	4	70	Yes	77	7	Yes	77	7	Yes
R3-2	3	68	Yes	69	1	Yes	69	1	Yes
R3-3	2	60	No	61	1	No	61	1	No
R3-4	2	70	Yes	71	1	Yes	71	1	Yes
R3-5[a]	4	72	Yes	77	5	Yes	77	5	Yes
R3-6	3	70	Yes	71	1	Yes	71	1	Yes
R3-7	2	61	No	63	2	No	64	3	No
R3-8[a]	3	67	Yes	70	3	Yes	70	3	Yes
R3-9	3	71	Yes	72	1	Yes	72	1	Yes
R3-10[a]	3	71	Yes	74	3	Yes	75	4	Yes
R3-11	2	71	Yes	73	2	Yes	72	1	Yes
R3-12	2	63	No	64	1	No	65	2	No
R3-13[b]	3	71	Yes	72	1	Yes	75	4	Yes
R3-14[c]	3	70	Yes	73	3	Yes	71	1	Yes
R3-15	3	60	No	62	2	No	61	1	No
R3-16[b]	4	71	Yes	72	1	Yes	76	5	Yes
R3-17[c]	3	71	Yes	75	4	Yes	71	0	Yes
R3-18[b]	2	69	Yes	69	0	Yes	72	3	Yes
R3-19[c]	2	71	Yes	77	6	Yes	72	1	Yes
R3-20	3	61	No	62	1	No	63	2	No
R3-21[b]	3	70	Yes	71	1	Yes	74	4	Yes
R3-22	1	70	Yes	70	0	Yes	74	4	Yes
R3-23[b]	1	71	Yes	72	1	Yes	76	5	Yes
R3-24[b]	1	71	Yes	72	1	Yes	76	5	Yes
R3-25[a]	3	70	Yes	72	2	Yes	74	4	Yes

See Exhibit 4.10-12: Noise Receptor Locations – Segment 3, R3-1 to R3-25 on page 4-99 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

[b] Potential or confirmed relocations under the West Alternative.

[c] Potential or confirmed relocations under the Minimize 4(f) Impacts Alternative.

Exhibit 4.10-4: Modeled Noise Levels (dBA): Segment 4 – 1300 North to 2300 North

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R4-1	3	73	Yes	74	1	Yes	72	–1	Yes
R4-2	8	60	No	60	0	No	61	1	No
R4-3	4	59	No	59	0	No	59	0	No
R4-4	3	58	No	59	1	No	58	0	No
R4-5	2	62	No	62	0	No	63	1	No
R4-6	4	70	Yes	71	1	Yes	72	2	Yes
R4-7[a]	1	70	Yes	71	1	Yes	72	2	Yes
R4-8	3	66	Yes	66	0	Yes	67	1	Yes
R4-9	4	61	No	61	0	No	62	1	No
R4-10[a]	3	73	Yes	74	1	Yes	77	4	Yes
R4-11[a]	4	73	Yes	74	1	Yes	76	3	Yes
R4-12	3	73	Yes	73	0	Yes	72	–1	Yes
R4-13[a]	3	71	Yes	72	1	Yes	73	2	Yes
R4-14	4	59	No	59	0	No	59	0	No
R4-15	4	59	No	59	0	No	59	0	No
R4-16	4	72	Yes	71	-1	Yes	71	–1	Yes
R4-17	4	62	No	63	1	No	63	1	No
R4-18	1	69	Yes	71	2	Yes	71	2	Yes

See Exhibit 4.10-13: Noise Receptor Locations – Segment 4, R4-1 to R4-18 on page 4-100 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

Exhibit 4.10-5: Modeled Noise Levels (dBA): Segment 5 – 2300 North to 5600 South

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R5-1	2	59	No	60	1	No	60	1	No
R5-2	2	59	No	59	0	No	59	0	No
R5-3	2	72	Yes	71	–1	Yes	71	–1	Yes
R5-4	1	64	No	63	–1	No	63	–1	No
R5-5	3	74	Yes	73	–1	Yes	73	–1	Yes
R5-6	3	73	Yes	72	–1	Yes	72	–1	Yes
R5-7	1	72	Yes	72	0	Yes	75	3	Yes
R5-8[a]	4	73	Yes	72	–1	Yes	77	4	Yes
R5-9	2	67	Yes	67	0	Yes	69	2	Yes
R5-10	2	67	Yes	67	0	Yes	69	2	Yes
R5-11	3	59	No	60	1	No	59	0	No
R5-12	2	72	Yes	72	0	Yes	71	–1	Yes
R5-13	2	71	Yes	71	0	Yes	70	–1	Yes
R5-14	3	63	No	63	0	No	62	–1	No
R5-15	3	72	Yes	73	1	Yes	71	–1	Yes
R5-16	5	62	No	62	0	No	62	0	No
R5-17	4	72	Yes	73	1	Yes	71	–1	Yes
R5-18	4	71	Yes	71	0	Yes	73	2	Yes
R5-19	3	71	Yes	71	0	Yes	72	1	Yes
R5-20	2	72	Yes	73	1	Yes	72	0	Yes
R5-21	2	71	Yes	71	0	Yes	71	0	Yes
R5-22	3	72	Yes	72	0	Yes	72	0	Yes

See Exhibit 4.10-14: Noise Receptor Locations – Segment 5, R5-1 to R5-22 on page 4-101 for receptor locations.

[a] Potential or confirmed relocations under the West Alternative.

Exhibit 4.10-6: Modeled Noise Levels (dBA): Segment 6 – 5600 South to 4800 South

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R6-1	4	54	No	56	2	No	56	2	No
R6-2	4	68	Yes	71	3	Yes	71	3	Yes
R6-3	4	59	No	61	2	No	61	2	No
R6-4	5	70	Yes	72	2	Yes	72	2	Yes
R6-5[a]	3	70	Yes	73	3	Yes	74	4	Yes
R6-6	3	70	Yes	71	1	Yes	70	0	Yes
R6-7	4	59	No	61	2	No	61	2	No
R6-8	3	70	Yes	72	2	Yes	70	0	Yes
R6-9	3	61	No	63	2	No	62	1	No
R6-10[a]	4	67	Yes	69	2	Yes	70	3	Yes
R6-11	2	61	No	62	1	No	62	1	No
R6-12	3	70	Yes	72	2	Yes	71	1	Yes
R6-13[a]	4	70	Yes	72	2	Yes	73	3	Yes
R6-14	2	70	Yes	72	2	Yes	71	1	Yes
R6-15	4	61	No	62	1	No	62	1	No
R6-16	3	71	Yes	73	2	Yes	71	0	Yes
R6-17[a]	3	70	Yes	72	2	Yes	73	3	Yes
R6-18[a]	3	65	No	66	1	Yes	68	3	Yes
R6-19	4	71	Yes	73	2	Yes	71	0	Yes
R6-20	4	56	No	57	1	No	57	1	No
R6-21	5	70	Yes	72	2	Yes	71	1	Yes
R6-22	4	64	No	65	1	No	64	0	No
R6-23	4	73	Yes	73	0	Yes	72	–1	Yes
R6-24	3	67	Yes	68	1	Yes	67	0	Yes

See Exhibit 4.10-15: Noise Receptor Locations – Segment 6, R6-1 to R6-24 on page 4-102 for receptor locations.

[a] Potential or confirmed relocations under the West Alternative.

Exhibit 4.10-7: Modeled Noise Levels (dBA): Segment 7 – 4800 South to 4000 South

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R7-1	3	69	Yes	73	4	Yes	71	2	Yes
R7-2	3	69	Yes	72	3	Yes	71	2	Yes
R7-3	3	69	Yes	72	3	Yes	71	2	Yes
R7-4	2	64	No	67	3	Yes	65	1	No
R7-5	2	56	No	59	3	No	59	3	No
R7-6	3	60	No	64	4	No	63	3	No
R7-7	2	59	No	63	4	No	62	3	No
R7-8	2	69	Yes	73	4	Yes	71	2	Yes
R7-9	3	60	No	63	3	No	63	3	No
R7-10	2	65	No	69	4	Yes	67	2	Yes
R7-11	3	69	Yes	72	3	Yes	71	2	Yes
R7-12	4	59	No	63	4	No	62	3	No
R7-13	2	69	Yes	72	3	Yes	71	2	Yes
R7-14	2	68	Yes	71	3	Yes	69	1	Yes
R7-15	3	61	No	64	3	No	63	2	No
R7-16	3	69	Yes	73	4	Yes	71	2	Yes
R7-17	3	62	No	65	3	No	64	2	No
R7-18	4	69	Yes	72	3	Yes	71	2	Yes
R7-19	2	63	No	66	3	Yes	65	2	No
R7-20	1	64	No	66	2	Yes	66	2	Yes
R7-21	1	69	Yes	70	1	Yes	70	1	Yes

See Exhibit 4.10-16: Noise Receptor Locations – Segment 7, R7-1 to R7-21 on page 4-103 for receptor locations.

Exhibit 4.10-8: Modeled Noise Levels (dBA): Segment 8 – 4000 South to 3600 South

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R8-1	3	56	No	59	3	No	59	3	No
R8-2	2	66	Yes	68	2	Yes	68	2	Yes
R8-3	4	64	No	70	6	Yes	70	6	Yes
R8-4	1	67	Yes	69	2	Yes	69	2	Yes
R8-5	2	60	No	64	4	No	64	4	No
R8-6	2	64	No	69	5	Yes	69	5	Yes
R8-7	1	68	Yes	70	2	Yes	70	2	Yes
R8-8	3	54	No	57	3	No	57	3	No
R8-9	2	56	No	59	3	No	59	3	No
R8-10	2	57	No	61	4	No	61	4	No
R8-11	2	57	No	61	4	No	61	4	No
R8-12[a]	1	67	Yes	73	6	Yes	73	6	Yes
R8-13	4	55	No	58	3	No	58	3	No
R8-14	2	63	No	65	2	No	65	2	No
R8-15	2	58	No	62	4	No	61	3	No
R8-16	3	56	No	59	3	No	59	3	No
R8-17	2	60	No	63	3	No	63	3	No
R8-18	3	57	No	61	4	No	61	4	No
R8-19	2	69	Yes	71	2	Yes	71	2	Yes
R8-20[a]	2	64	No	70	6	Yes	70	6	Yes
R8-21[a]	1	69	Yes	75	6	Yes	76	7	Yes
R8-22[a]	2	66	Yes	71	5	Yes	72	6	Yes
R8-23	3	62	No	65	3	No	65	3	No
R8-24	3	58	No	62	4	No	62	4	No
R8-25	3	61	No	64	3	No	64	3	No
R8-26	3	67	Yes	70	3	Yes	69	2	Yes
R8-27	3	59	No	62	3	No	62	3	No
R8-28	3	57	No	61	4	No	61	4	No
R8-29	2	67	Yes	71	4	Yes	69	2	Yes
R8-30	3	68	Yes	71	3	Yes	70	2	Yes

Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Minimize 4(f) Impacts Alternative			West Alternative		
				Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R8-31	3	60	No	63	3	No	63	3	No
R8-32	2	68	Yes	71	3	Yes	70	2	Yes
R8-33	3	59	No	63	4	No	62	3	No
R8-34	2	68	Yes	72	4	Yes	71	3	Yes
R8-35	3	64	No	67	3	Yes	66	2	Yes
R8-36	3	57	No	61	4	No	61	4	No
R8-37[a]	1	69	Yes	73	4	Yes	75	6	Yes
R8-38[a]	1	69	Yes	73	4	Yes	75	6	Yes
R8-39	1	67	Yes	70	3	Yes	69	2	Yes
R8-40[b]	1	69	Yes	74	5	Yes	75	6	Yes
R8-41	1	62	No	68	6	Yes	68	6	Yes

See Exhibit 4.10-17: Noise Receptor Locations – Segment 8, R8-1 to R8-41 on page 4-104 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

[b] Potential or confirmed relocations under the West Alternative.

Exhibit 4.10-9: Modeled Noise Levels (dBA): Segment 9 – 3600 South to 1900 West

				Minimize 4(f) Impacts Alternative			West Alternative		
Receptor	Number of Dwelling Units	Existing Sound Level (L_{eq})	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?	Modeled Sound Level (L_{eq})	Change From Existing	Exceeds Standard?
R9-1	1	67	Yes	74	7	Yes	74	7	Yes
R9-2	1	69	Yes	74	5	Yes	74	5	Yes
R9-3	1	69	Yes	74	5	Yes	74	5	Yes
R9-4[a]	1	67	Yes	73	6	Yes	73	6	Yes
R9-5[a]	1	68	Yes	74	6	Yes	74	6	Yes
R9-6	1	67	Yes	71	4	Yes	71	4	Yes
R9-7	4	70	Yes	74	4	Yes	74	4	Yes
R9-8	4	68	Yes	74	6	Yes	74	6	Yes
R9-9	4	67	Yes	73	6	Yes	73	6	Yes
R9-10	4	68	Yes	74	6	Yes	74	6	Yes
R9-11	4	68	Yes	73	5	Yes	73	5	Yes
R9-12[a]	1	68	Yes	73	5	Yes	73	5	Yes
R9-13[b]	Unknown	66	Yes	71	5	Yes	71	5	Yes

See Exhibit 4.10-18: Noise Receptor Locations – Segment 9, R9-1 to R9-13 on page 4-105 for receptor locations.

[a] Potential or confirmed relocations under both alternatives.

[b] Future apartments/townhomes.

Exhibit 4.10-10: Noise Receptor Locations – Segment 1, R1-1 to R1-25

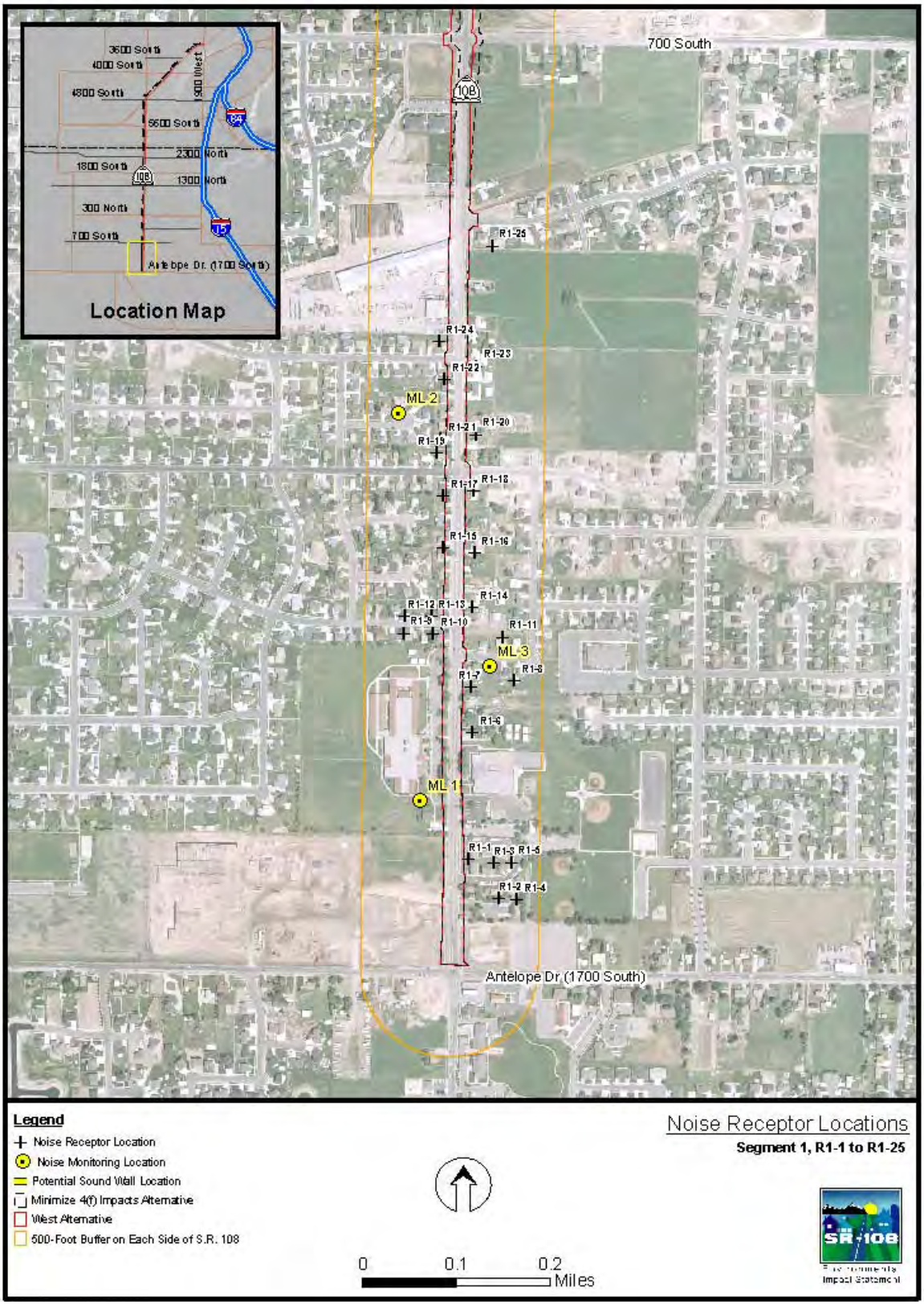


Exhibit 4.10-11: Noise Receptor Locations – Segment 2, R2-1 to R2-29

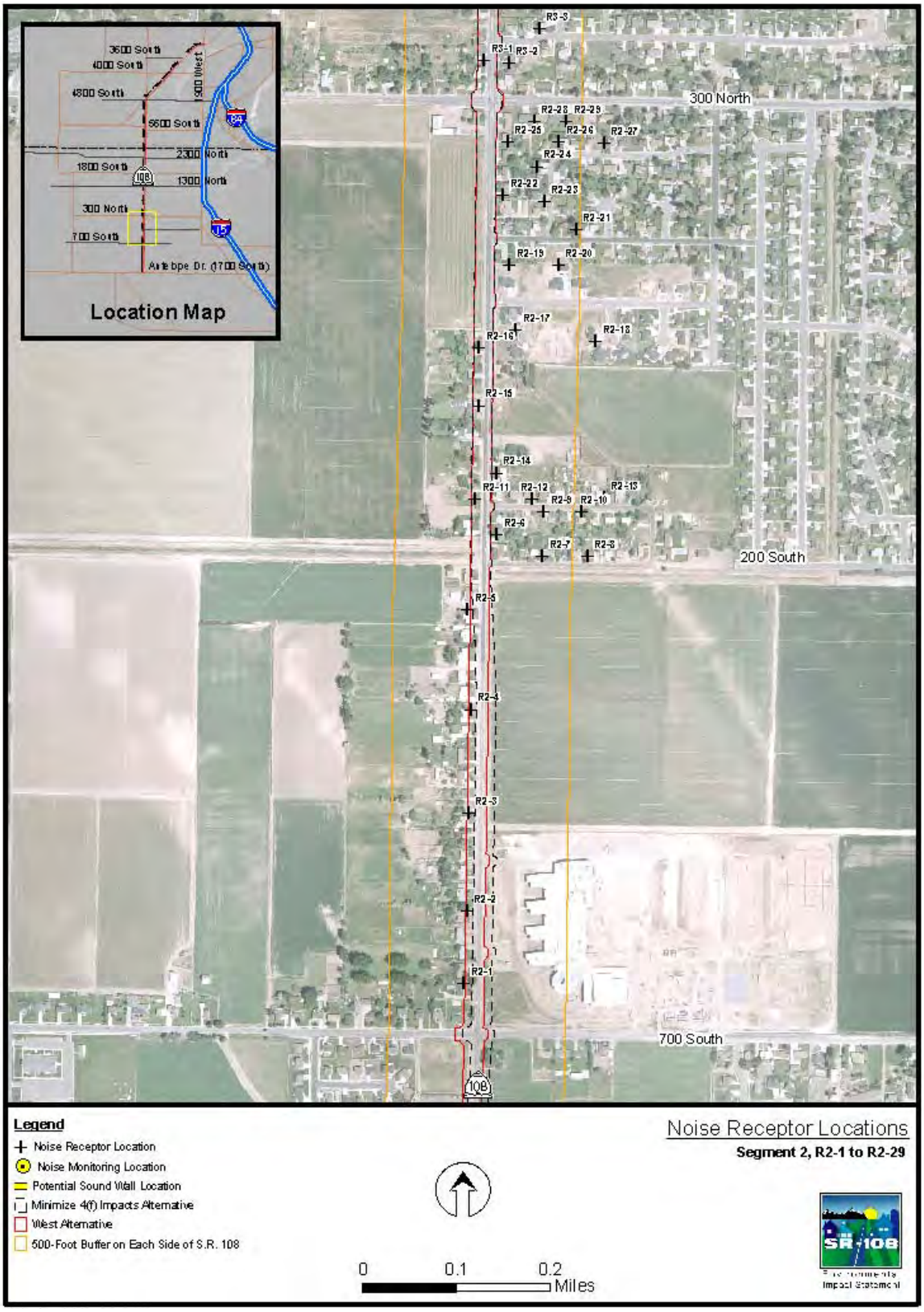


Exhibit 4.10-12: Noise Receptor Locations – Segment 3, R3-1 to R3-25

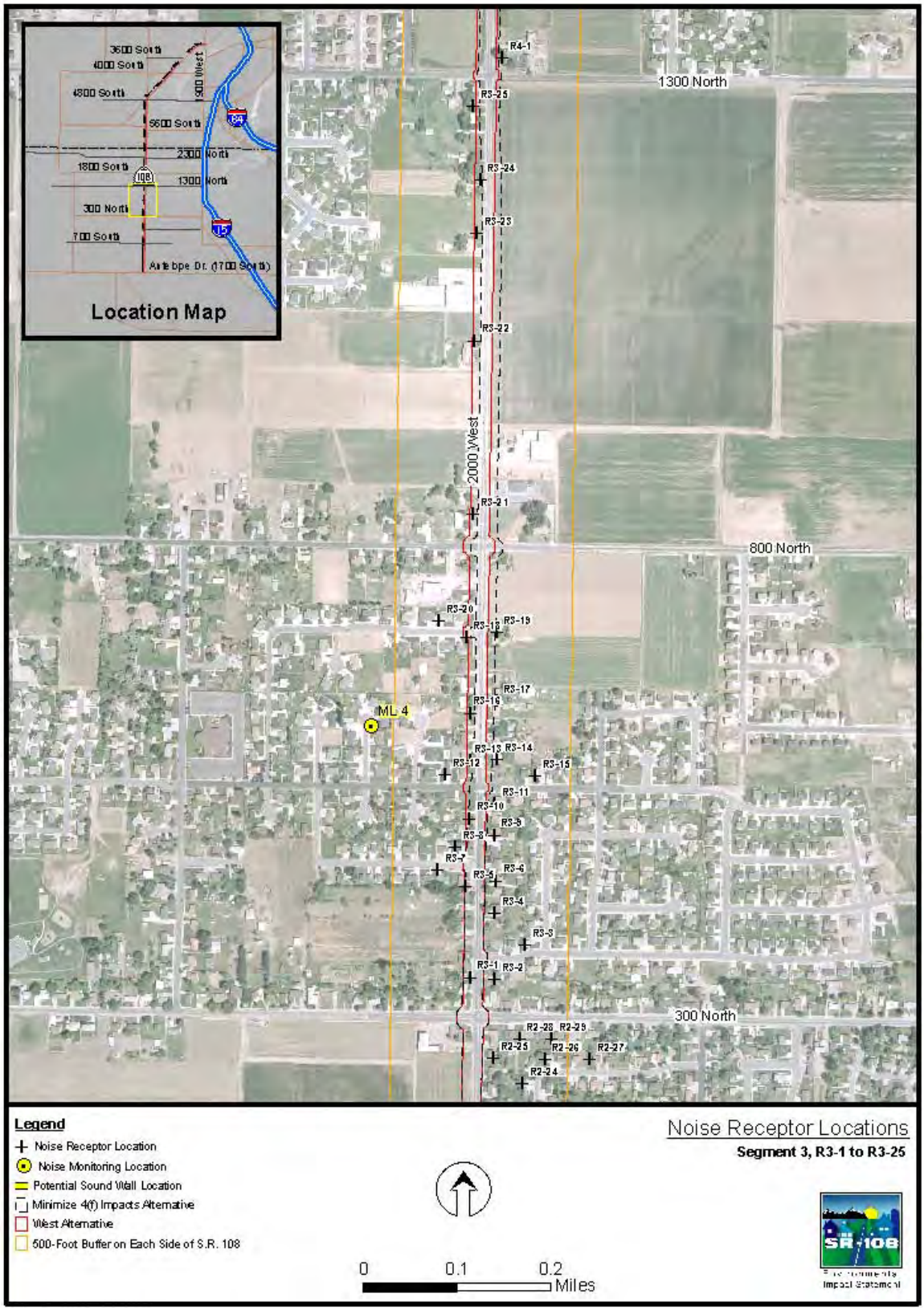


Exhibit 4.10-13: Noise Receptor Locations – Segment 4, R4-1 to R4-18

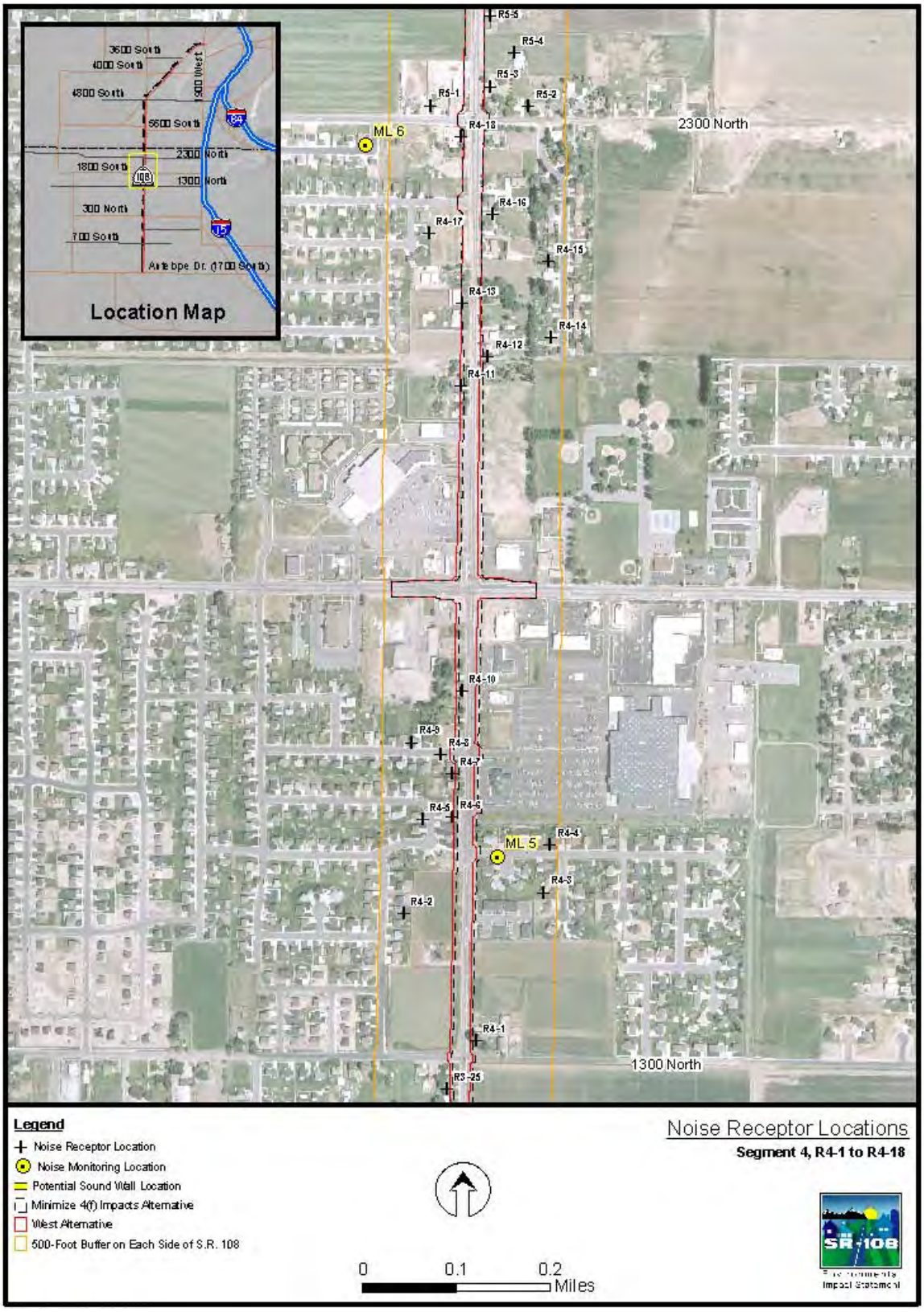


Exhibit 4.10-14: Noise Receptor Locations – Segment 5, R5-1 to R5-22

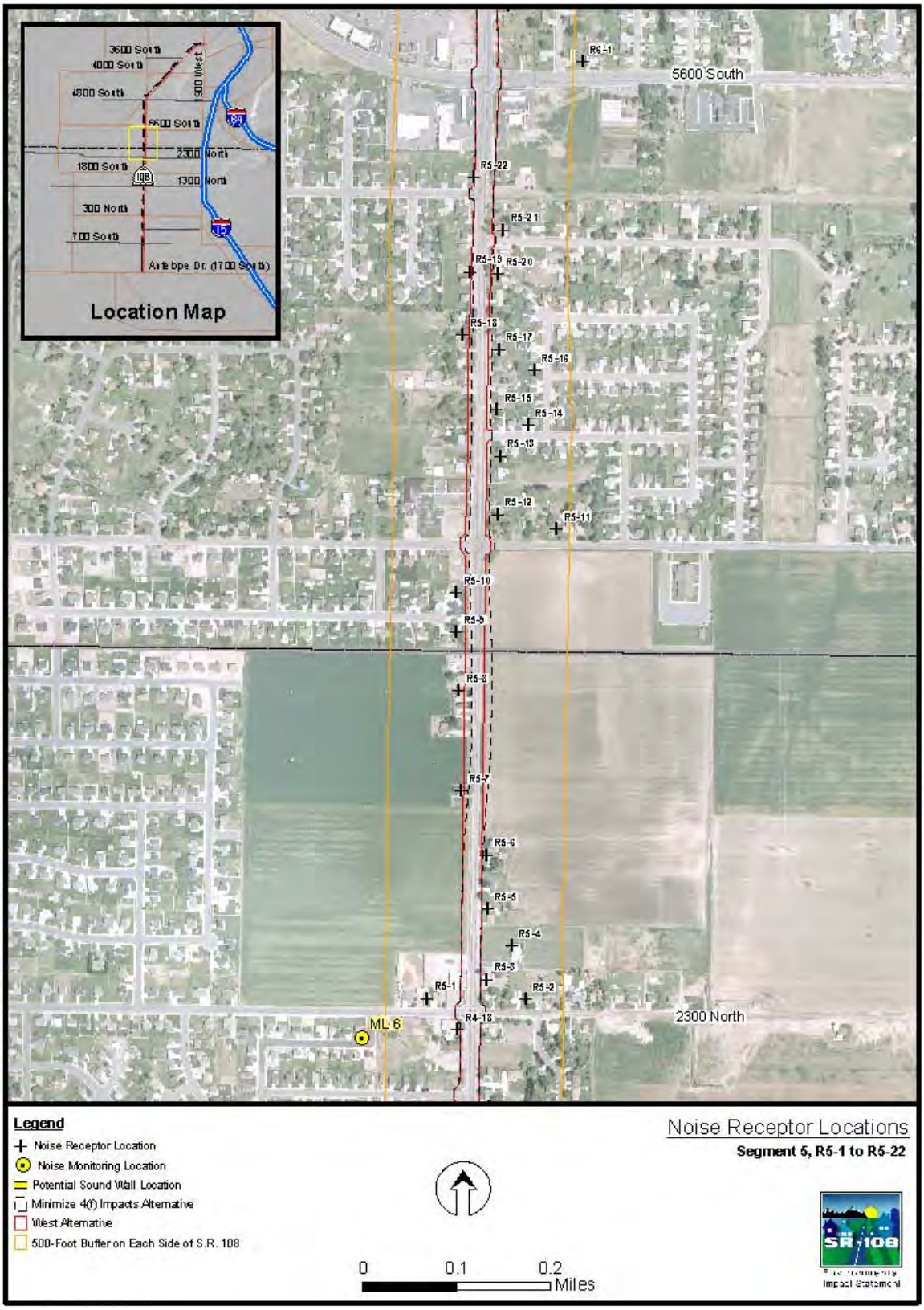


Exhibit 4.10-15: Noise Receptor Locations – Segment 6, R6-1 to R6-24

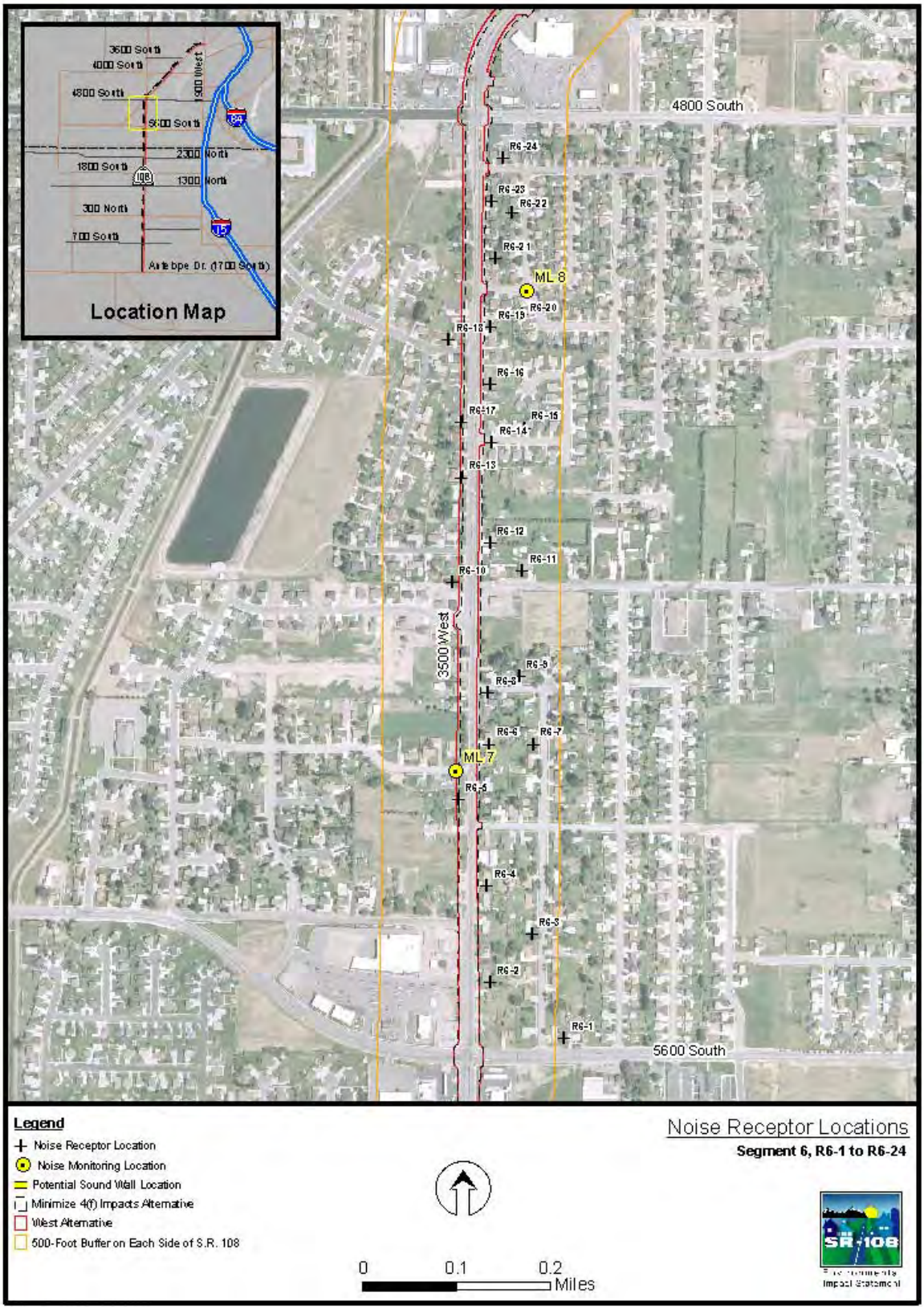


Exhibit 4.10-16: Noise Receptor Locations – Segment 7, R7-1 to R7-21

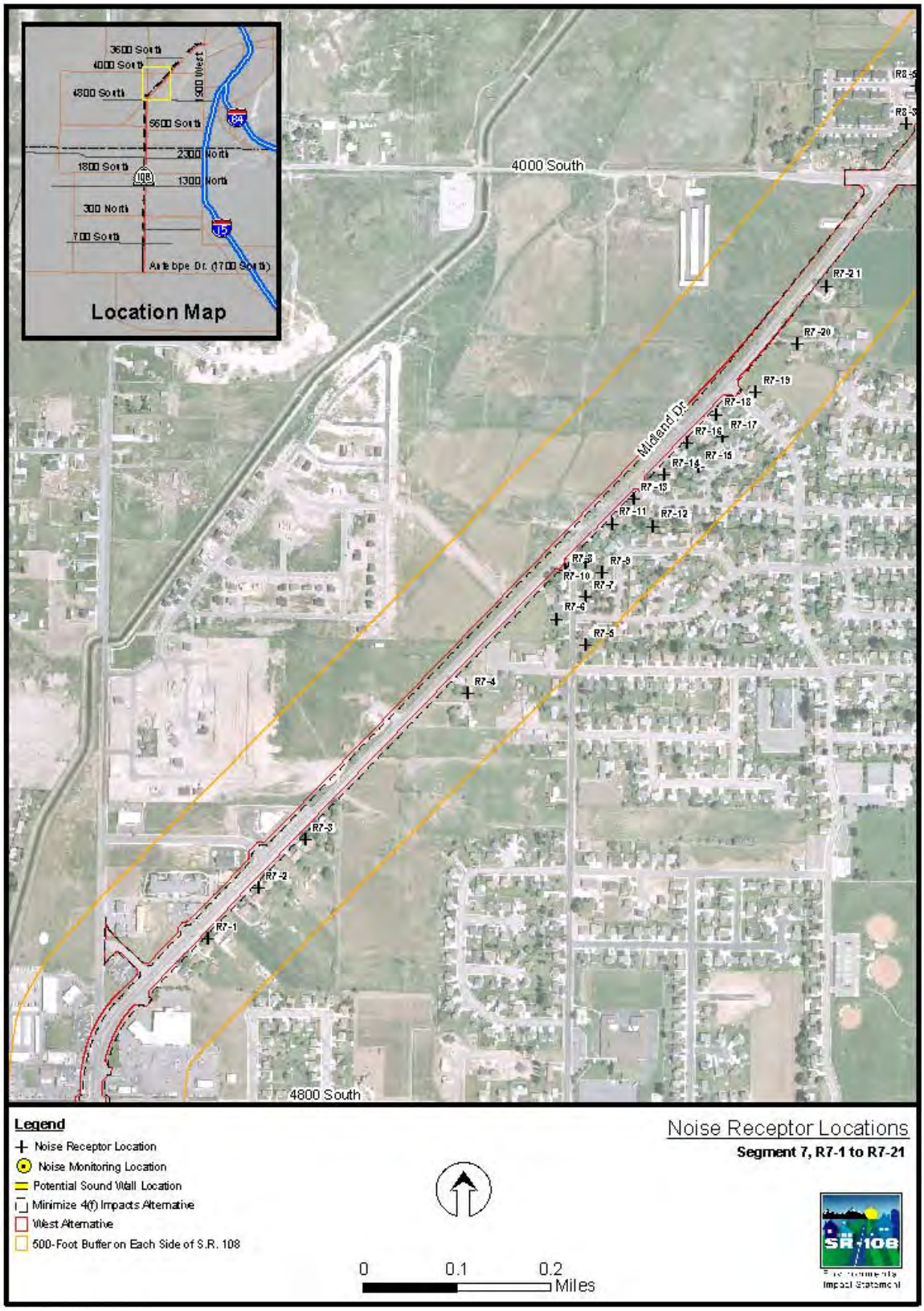


Exhibit 4.10-17: Noise Receptor Locations – Segment 8, R8-1 to R8-41

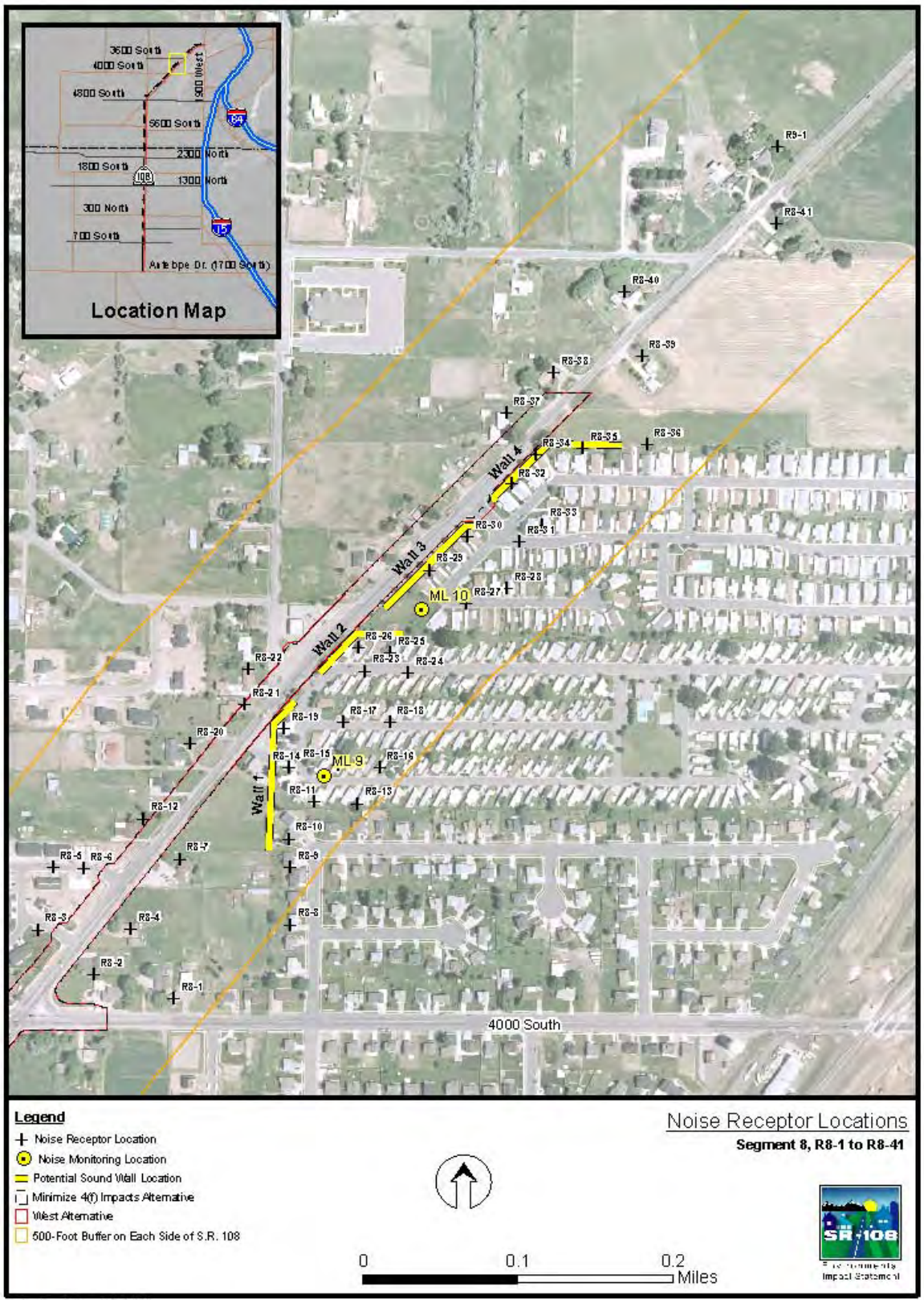


Exhibit 4.10-18: Noise Receptor Locations – Segment 9, R9-1 to R9-13

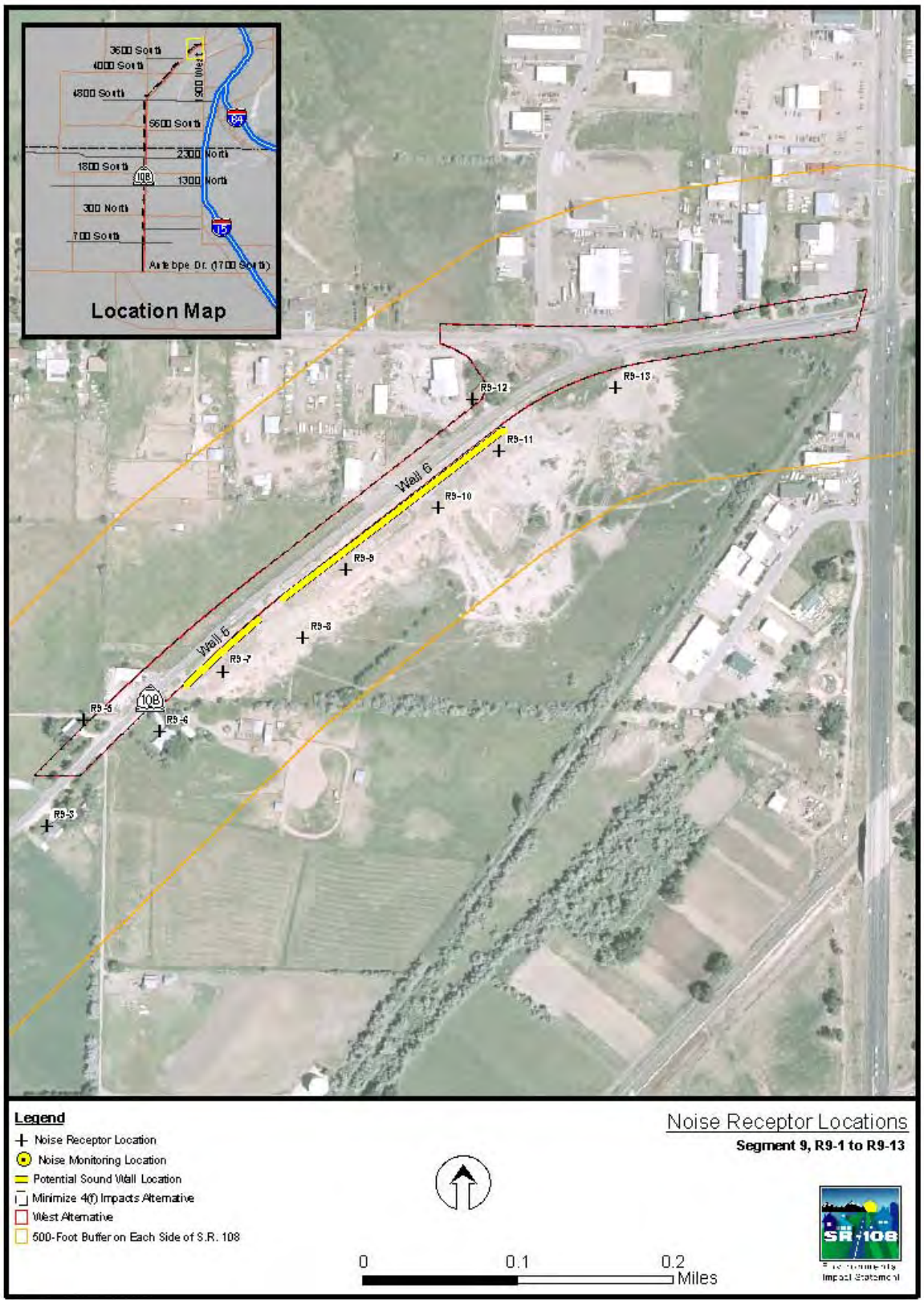


Exhibit 4.10-19: Noise Mitigation Analysis – Wall 1

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease	16 foot Level	16 foot Decrease	18 foot Level	18 foot Decrease
1st-row residences	8	61–71	57–61	4–10	57–60	4–11	57–60	4–12	56–59	3–12
2nd row and beyond	8	58–63	58–63	2–10	56–61	2–3	56–61	2–4	56–61	2–4

Benefiting Residences	12 foot	14 foot	16 foot	18 foot
Number of benefiting residences (at least 5 dBA)	4	4	6	6
Maximum reduction, dBA	10	11	12	12

UDOT Feasibility Requirements	12 foot	14 foot	16 foot	18 foot
1 residence >10 dBA reduction from a wall?	Yes	Yes	Yes	Yes
50% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	12 foot	14 foot	16 foot	18 foot
Length of modeled wall, feet	547	547	547	547
Wall area (547 feet × wall height), square feet	6,564	7,658	8,752	9,846
Wall cost ($15 × area)	$131,280	$153,160	$175,040	$196,920
Cost per benefiting residence	$32,820	$38,290	$29,173	$32,820
Is wall cost-effective?	**No**	**No**	**Yes**	**No**
Is wall feasible and cost-effective?	**No**	**No**	**Yes**	**No**

Exhibit 4.10-20: Noise Mitigation Analysis – Wall 2

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease	16 foot Level	16 foot Decrease	18 foot Level	18 foot Decrease
1st-row residences	3	69	63	6	63	6	63	6	62	7
2nd row and beyond	9	62–65	60–62	2–4	59–61	2–5	59–61	3–5	59–61	3–5

Benefiting Residences	12 foot	14 foot	16 foot	18 foot
Number of benefiting residences (at least 5 dBA)	3	6	6	6
Maximum reduction, dBA	6	6	6	7

UDOT Feasibility Requirements	12 foot	14 foot	16 foot	18 foot
1 residence >10 dBA reduction from a wall?	No	No	No	No
50% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	12 foot	14 foot	16 foot	18 foot
Length of modeled wall, feet	308	308	308	308
Wall area (308 feet × wall height), square feet	3,696	4,312	4,928	5,544
Wall cost ($15 × area)	$73,920	$86,240	$98,560	$110,880
Cost per benefiting residence	$24,620	$14,273	$16,427	$18,480
Is wall cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**
Is wall feasible and cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Exhibit 4.10-21: Noise Mitigation Analysis – Wall 3

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease	16 foot Level	16 foot Decrease	18 foot Level	18 foot Decrease
1st-row residences	5	69–70	60–61	9–10	59–60	9–11	59	10–12	58–59	10–12
2nd row and beyond	12	61–63	59–61	1–3	59–61	1–3	58–61	1–3	58–61	1–3

Benefiting Residences	12 foot	14 foot	16 foot	18 foot
Number of benefiting residences (at least 5 dBA)	5	5	5	5
Maximum reduction, dBA	10	11	12	12

UDOT Feasibility Requirements	12 foot	14 foot	16 foot	18 foot
1 residence >10 dBA reduction from a wall?	Yes	Yes	Yes	Yes
50% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	12 foot	14 foot	16 foot	18 foot
Length of modeled wall, feet	410	410	410	410
Wall area (410 feet × wall height), square feet	4,920	5,740	6,560	7,380
Wall cost ($15 × area)	$98,400	$114,800	$131,200	$147,600
Cost per benefiting residence	$19,680	$22,960	$26,240	$29,520
Is wall cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Is wall feasible and cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Exhibit 4.10-22: Noise Mitigation Analysis – Wall 4

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease	16 foot Level	16 foot Decrease	18 foot Level	18 foot Decrease
1st-row residences	7	66–71	59–61	7–10	58–60	8–12	57–59	8–13	57–58	9–14
2nd row and beyond	6	61–62	60	1–2	60	1–2	60	1–3	59–60	1–3

Benefiting Residences	12 foot	14 foot	16 foot	18 foot
Number of benefiting residences (at least 5 dBA)	7	7	7	7
Maximum reduction, dBA	10	12	13	14

UDOT Feasibility Requirements	12 foot	14 foot	16 foot	18 foot
1 residence >10 dBA reduction from a barrier?	Yes	Yes	Yes	Yes
50% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	12 foot	14 foot	16 foot	18 foot
Length of modeled wall, feet	426	426	426	426
Wall area (426 feet × wall height), square feet	5,112	5,964	6,816	7,668
Wall cost ($15 × area)	$102,240	$119,280	$136,320	$153,360
Cost per benefiting residence	$14,606	$17,040	$19,474	$21,909
Is wall cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**
Is wall feasible and cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Exhibit 4.10-23: Noise Mitigation Analysis – Wall 5

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	8 foot Level	8 foot Decrease	10 foot Level	10 foot Decrease	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease
1st-row residences	10	72–73	64–68	5–9	62–68	5–11	62–68	5–11	61–68	5–12

	8 foot	10 foot	12 foot	14 foot
Number of benefiting residences (at least 5 dBA)	10	10	10	10
Maximum reduction, dBA	9	11	11	12

UDOT Feasibility Requirements	8 foot	10 foot	12 foot	14 foot
1 residence >10 dBA reduction from a barrier?	No	Yes	Yes	Yes
75% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	8 foot	10 foot	12 foot	14 foot
Length of modeled wall, feet	360	360	360	360
Wall area (360 feet × wall height), square feet	2,880	3,600	4,320	5,040
Wall cost ($20 × area)	$57,600	$72,000	$86,400	$100,800
Cost per benefiting residence	$5,760	$7,200	$8,640	$10,080
Is wall cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Is wall feasible and cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Exhibit 4.10-24: Noise Mitigation Analysis – Wall 6

Noise Reduction (in dBA) Location	Dwelling Units	No Wall	8 foot Level	8 foot Decrease	10 foot Level	10 foot Decrease	12 foot Level	12 foot Decrease	14 foot Level	14 foot Decrease
1st-row residences	12	68–74	62–64	6–10	62	7–11	61–62	7–12	60–61	8–13

	8 foot	10 foot	12 foot	14 foot
Number of benefiting residences (at least 5 dBA)	12	12	12	12
Maximum reduction, dBA	10	11	12	12

UDOT Feasibility Requirements	8 foot	10 foot	12 foot	14 foot
1 residence >10 dBA reduction from a barrier?	Yes	Yes	Yes	Yes
75% or more 1st row >5 dBA reduction?	Yes	Yes	Yes	Yes
Is wall feasible?	**Yes**	**Yes**	**Yes**	**Yes**

UDOT Cost Effectiveness Requirements	8 foot	10 foot	12 foot	14 foot
Length of modeled wall, feet	950	950	950	950
Wall area (950 feet × wall height), square feet	7,600	9,500	11,400	13,300
Wall cost ($20 × area)	$152,000	$190,000	$228,000	$266,000
Cost per benefiting residence	$12,667	$15,833	$19,000	$22,167
Is wall cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

Is wall feasible and cost-effective?	**Yes**	**Yes**	**Yes**	**Yes**

4.11 Water Quality Impacts

This section discusses the expected water quality impacts to surface water and groundwater from the No-Action and action alternatives. The impact analysis consisted of identifying typical contaminants found in highway runoff and determining whether these contaminants would affect the beneficial-use classifications of the surface waters and groundwater in the water quality impact analysis area. The groundwater impact analysis also identified the number of wells that would be affected by each alternative.

What is the water quality impact analysis area?

The water quality impact analysis area includes the water bodies that could be affected by construction and operation of S.R. 108.

4.11.1 No-Action Alternative

Under the No-Action Alternative, no improvements would be made to S.R. 108 except for routine maintenance. Stormwater runoff would continue to run from the roadway directly into the nearby sloughs and canals without passing through any stormwater detention features. Under this alternative, the stormwater runoff from S.R. 108, which could contain total suspended solids (TSS) from roadside erosion and from de-icing activities, would go through the same water quality treatment process as runoff under the current conditions.

What are beneficial uses?

Lakes, rivers, and other water bodies have uses to humans and other life. These uses are called *beneficial uses*. The State of Utah defines 13 different beneficial uses for rivers, streams, lakes, and reservoirs in Utah (see Exhibit 3.11-1: Designated Beneficial Uses for Rivers, Streams, Lakes, and Reservoirs in Utah).

4.11.2 Minimize 4(f) Impacts Alternative

To evaluate impacts from the Minimize 4(f) Impacts Alternative, typical contaminants from highway runoff were identified. Some of the contaminants listed in Exhibit 4.11-1 below were evaluated to determine if the action alternatives would degrade water quality along S.R. 108 and in the waters downstream of the roadway.

Exhibit 4.11-1: Typical Highway Runoff Contaminants

Contaminant	Source
Bromide	Vehicle exhaust
Cadmium	Tire wear, insecticide application
Chloride	De-icing salts
Chromium	Metal plating, engine parts, brake lining wear
Copper	Metal plating, bearing wear, engine parts, brake lining wear, fungicide and insecticide use
Cyanide	Anticake compound used to keep de-icing salts granular
Iron	Auto body rust, steel structures, engine parts
Lead	Leaded gasoline, tire wear, lubricating oil and grease, bearing wear, atmospheric deposition
Manganese	Engine parts
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Nitrogen, phosphorous	Atmosphere, roadside fertilizer use, sediments
Particulates (sediments or TSS)	Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance
Pathogenic bacteria	Soil, litter, bird droppings, trucks hauling livestock/ stockyard waste
Polychlorinated biphenyls (PCBs), pesticides	Spraying of highway rights-of-way, atmospheric deposition, PCB catalyst in synthetic tires
Petroleum	Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate
Rubber	Tire wear
Sodium, calcium	De-icing salts, grease
Sulfate	Roadway beds, fuel, de-icing salts
Total dissolved solids (TDS)	De-icing salts, vehicle deposits, pavement wear
Zinc	Tire wear, motor oil, grease

Source: FHWA 1996, 34

4.11.2.1 Methodology for Determining Impacts to Surface Waters

Neither of the S.R. 108 action alternatives would cross any natural rivers or creeks. However, a few unnamed drainage canals cross under S.R. 108. For the purpose of the surface water quality analysis, the impact analysis area includes Howard Slough, Hooper Canal, and the Great Salt Lake.

- Howard Slough has beneficial-use classifications of 2B, 3C, and 4 (protected for secondary contact recreation, non-game fish and other aquatic life, and agricultural uses).
- UDEQ (Utah Administrative Code R317) does not specifically list beneficial uses for the Hooper Canal.
- The Great Salt Lake is classified as a Class 5 water. Class 5 waters are protected for primary and secondary contact recreation, aquatic wildlife, and mineral extraction. UDEQ has established a narrative standard for the beneficial uses of the Great Salt Lake, but no numeric standards are currently in effect.

Therefore, water quality impacts were evaluated with respect to the beneficial uses for Howard Slough because it has the most stringent water quality standards associated with its beneficial use classifications compared to the Hooper Canal and the Great Salt Lake. If an alternative would not affect the beneficial uses of Howard Slough, then it would not affect the beneficial uses of any other surface waters in the water quality impact analysis area.

Exhibit 4.11-2 presents the primary contaminants in highway runoff that also have numeric criteria associated with the designated beneficial uses of Howard Slough (2B, 3C, and 4).

What is the narrative standard for Utah waters?

The narrative standard is applied to all waters in Utah. This standard states:

"It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures."

Exhibit 4.11-2: Numeric Criteria Associated with Beneficial Uses of Howard Slough

Beneficial Uses of Howard Slough	Phosphorus (total, mg/L)	Turbidity (increase, NTU)	pH	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Zinc (mg/L)	TDS (Irrigation/ Stock Watering) (mg/L)
2B (secondary contact)	0.05	10	6.5–9.0	—	—	—	—
3C (non-game fish)	—	15	6.5–9.0	0.013	0.065	0.120	—
4 (agriculture)	—	—	6.5–9.0	0.2	0.1	—	1,200/2,000

Source: Utah Administrative Code R317

NTU = nephelometric turbidity units

Class 2B Numeric Criteria

The Class 2B beneficial uses include numeric criteria for phosphorus, turbidity, and pH. Turbidity is a physical measure of water clarity, and the standard applies to turbidity increases. TSS concentrations could also be used as a surrogate to evaluate turbidity. There is no numeric standard for TSS.

Phosphorus. Phosphorous levels in roadway stormwater runoff can result from erosion of roadside sediments or from direct application of phosphorus, usually in the form of fertilizer. The project would include a storm drain system, so increases in phosphorus levels would be limited.

Turbidity and TSS. TSS is present in highway runoff from pavement wear, vehicles, the atmosphere, maintenance, snow/ice abrasives, and disturbed sediment. The storm drainage system proposed for the project includes detention basins to control flow rates. These detention basins allow sediment and other large suspended particles associated with roadway runoff to settle out of the stormwater. TSS can also result from erosion of roadside soils when stormwater erodes steep roadside embankments or when high-velocity water erodes soil at the outlet of crossing culverts. The Minimize 4(f) Impacts Alternative would include a storm drainage system, so erosion of roadside soils would be minor.

The greatest potential for the project to increase TSS and turbidity is during construction. A construction UDPES permit, which prescribes best management practices to control pollution leaving the construction site, would be required for the project. The permit conditions would require the use of erosion-control measures such as silt fences to reduce impacts to adjacent waters.

pH. The other numeric water quality criterion for Class 2B waters is pH, which is not a common constituent in highway stormwater runoff but is a measure of water quality. The Minimize 4(f) Impacts Alternative would have no effect on pH levels in receiving waters.

Class 3C and Class 4 Numeric Criteria

Four additional constituents were analyzed to determine the expected impacts to the Class 3C and Class 4 beneficial uses: copper, lead, zinc, and total dissolved solids (TDS). Copper, lead, and zinc are the dominant heavy-metal pollutants in roadway stormwater runoff and have numeric water quality criteria associated with Class 3C beneficial uses. The impacts from the three toxic heavy metals were modeled using the FHWA numerical water quality model (see the following paragraph). TDS was assessed by modeling the application of de-icing chemicals to S.R. 108 and estimating the resulting TDS concentrations in stormwater runoff and by comparing typical event mean concentrations, which are measured values, to the applicable numeric water quality criteria. The Class 4 beneficial use has numeric water quality criteria for TDS. The beneficial uses are for two agricultural uses of water: crop irrigation and stock watering.

Methodology for Analysis of Heavy Metals (Copper, Lead, and Zinc). FHWA's numerical water quality model was used to quantify the impacts of metals in the runoff from S.R. 108. The model is explained in two FHWA research documents: FHWA-RD-88-006, *Pollutant Loadings and Impacts from Highway Stormwater Runoff* (FHWA 1990), and FHWA-RD-96-095, *Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff* (FHWA 1996). The model used for this analysis is a probabilistic dilution model developed and applied in EPA's Nationwide Urban Runoff Program and reviewed and approved by EPA's Science Advisory Board. This model provides an estimate of the one-time-every-3-years, in-stream concentration of a pollutant after mixing (FHWA 1990, 1–2). This frequency is used because UDEQ allows these water quality criteria to be exceeded only one time in a 3-year period.

Model Inputs. The average flow rate for Howard Slough was determined by reviewing data from a U.S. Geological Survey gage on Howard Slough between 1972 and 1984, which are the most recent data available. Because UDEQ does not maintain water quality data for Howard Slough, the existing background concentrations of copper, lead, and zinc are assumed to be similar to the concentrations in the lower reaches of the Weber River watershed. Water quality data for the Weber River indicate that the

concentrations of these pollutants were below the laboratory detection limit for the majority of samples collected (EPA 2007c). The background concentration was assumed to be half the detection limit. Concentrations of copper, lead, and zinc in the stormwater runoff are assumed to be similar to the event mean concentrations as analyzed from samples collected during storm events for various locations in Salt Lake County from 1992 to June 2000. These event mean concentrations were used since they are more site-specific than the average values suggested by the numerical analysis documentation (FHWA 1996). The values used in the analysis are shown in Exhibit 4.11-3. Exhibit 4.11-3 also includes typical concentrations of TSS and TDS.

Exhibit 4.11-3: Event Mean Concentrations during Sampled Storm Events

Pollutant	Event Mean Concentration (mg/L)
Total copper	0.039
Total lead	0.031
Total zinc	0.181
TSS	116
TDS (April, May, June, Sept., Oct.)	581 (storm composite)

Source: Stantec 2000

Water Quality Treatment Considerations. Runoff from S.R. 108 would be controlled through the use of detention features. These features would include detention ponds, grassed swales, or other means to control runoff and limit stormwater discharges to current levels. To determine the impacts from the project, the quality of water in the receiving stream was examined after mixing with roadway stormwater runoff after the stormwater left a "conceptual" (proposed) detention basin, which was sized to detain water from the longest stretch of roadway (about 2 miles). The pollutant removal rates stated in the FHWA documents were used in the calculations. Because some amount of the pollutant is dissolved in water, removal rates for specific pollutants are expressed as a fraction of the estimated TSS removal rate for a specific detention basin (for lead removal, FHWA documentation suggests 90% of the TSS removal; for copper, 60%; and for zinc, 45%).

The conceptual detention basins are small and are sized to detain only the excess stormwater generated from the increase in impervious (paved) area due to the proposed project. These small detention basins are anticipated to provide a minimum TSS removal rate of 40%. This figure is based on the size of the basin relative to the size of the area that would drain into the basin (FHWA 1996). So, for example, a conceptual detention basin would remove 24% of the copper in storm runoff, because the detention basin has a TSS removal rate of 40% and the suggested percentage for copper is 60% of this rate (60% of 40% is 24%).

Note that the project might use some of the larger regional detention basins that are planned for the area. If used, these larger basins would remove more pollutants than the conceptual basins that were analyzed for this project. The project could also control stormwater by using grassed swales or a combination of swales and detention basins.

4.11.2.2 Impacts to Surface Water

Class 3C Beneficial Use (Heavy Metals Analysis)

Exhibit 4.11-4 below presents the estimated pollutant removal rates and the modeled in-stream concentration of each pollutant. As shown in Exhibit 4.11-4, the modeled one-time-every-3-years concentrations would not exceed the numeric water quality standards in Exhibit 4.11-2: Numeric Criteria Associated with Beneficial Uses of Howard Slough above, so the Minimize 4(f) Impacts Alternative would not affect the Class 3C beneficial use of Howard Slough. Because Howard Slough has the most stringent water quality standards of the water bodies examined, the Minimize 4(f) Impacts Alternative would not degrade the water quality of the other water bodies with less-stringent standards.

Exhibit 4.11-4: Effects of Detention Basins on Water Quality and Water Quality Results

Pollutant	Percent of Pollutant Removed by Detention Basin	Resulting Concentration (mg/L)	Numeric Criteria for Beneficial Use Class 3C (mg/L)[a]
Copper	24%[b]	0.0126	0.013
Lead	36%[b]	0.002	0.065
Zinc	18%[b]	0.064	0.120

[a] Utah Administrative Code R317

[b] FHWA 1996, 72

Class 4 Beneficial Use (TDS Analysis)

Increases in TDS Due to Construction. The Minimize 4(f) Impacts Alternative could increase the amount of TDS in receiving waters during project construction. However, the required UPDES permit would include erosion-control measures such as silt fences that would reduce TDS impacts.

Increases in TDS Due to Salt Application. The greatest potential effect to the Class 4 beneficial use is from the application of salt to S.R. 108 during winter storms. Dissolved salts are typically measured as total dissolved solids, or TDS. UDOT applies salt (but not sand) to reduce ice and improve traction on roads during heavy snowfall. Along the Wasatch Front, UDOT uses the following two methods to apply salt during and before a predicted winter storm (Bernhard 2006):

- Beginning 24 hours before the predicted start of the storm, 30 gallons of 23% salt brine per lane-mile are applied.
- After the storm begins, a mixture of 4 gallons of 23% brine and 250 pounds of common salt per lane-mile is applied.

Stormwater runoff from the Interstate 215 (I-215) drainage system at the outlet to the Jordan River in Salt Lake County was sampled by Salt Lake County. This highway is much wider than S.R. 108, so runoff from I-215 should have more road-related contaminants. The typical concentrations of TDS from I-215 were 581 mg/L as shown above in Exhibit 4.11-3: Event Mean Concentrations during Sampled Storm Events (Stantec 2000). The modeled TDS concentration from the Minimize 4(f) Impacts Alternative was estimated at 927 mg/L

What is a typical concentration?

The *typical concentration* is the average, or mean, concentrations as measured from laboratory analysis samples of stormwater runoff.

based on the de-icing procedures described above. The observed concentrations are less because not all of the applied salt runs off with melting snow.

Both the modeled concentrations from the Minimize 4(f) Impacts Alternative and the observed concentrations from I-215 are less than the TDS criteria for beneficial use Class 4 for crop irrigation (1,200 mg/L) and stock watering (2,000 mg/L). However, TDS levels could be higher than the estimated concentrations in winter and early spring. The TDS standard applies to agricultural uses only. The majority of agricultural use occurs from middle to late spring through summer to the early fall. De-icing salts are not typically applied during these times of the year. Consequently, the largest TDS increases would occur during periods when most water is not being used for agriculture.

4.11.2.3 Impacts to Groundwater

This section discusses the expected impacts of the Minimize 4(f) Impacts Alternative on the East Shore aquifer system. The section discusses the potential for roadway improvements to affect groundwater quality and to affect groundwater rights and wells. The Utah Division of Water Quality does not generally require groundwater permits from UDOT for its transportation projects. Impacts to groundwater wells would not necessarily affect the overall groundwater quality, but they would inconvenience users of groundwater if a well was relocated or abandoned.

What is an aquifer?

An *aquifer* is an underground geologic formation that easily stores and transmits water. Aquifers can be composed of either porous rock or unconsolidated deposits of sand and gravel. An aquifer is said to be *confined* if it is covered by an impermeable layer of rock or clay. Due to this confining layer, the groundwater in confined aquifers is usually under pressure. Drilling a well into a confined aquifer can produce an *artesian well*—one where the pressurized water rises to the surface without the aid of a pump.

Groundwater Quality

The Minimize 4(f) Impacts Alternative could cause minor impacts to shallow groundwater as pollutants in runoff infiltrate the ground surface near the roadway. However, these impacts are not likely to decrease groundwater quality because the proposed drainage system would remove some pollutants and because the water quality of the shallow aquifer does not substantially affect the deeper aquifer, which is the typical water source for groundwater wells. In addition, the water quality impact analysis area is a substantial distance away from the primary deep aquifer recharge areas along the foothills of the Wasatch Mountains and along the Weber River delta.

Groundwater Rights and Wells

The Minimize 4(f) Impacts Alternative would directly affect 34 water rights points of diversion. Two surface water rights, which are storm drain systems, and 32 groundwater rights would be affected. Exhibit 4.11-5 and Exhibit 4.11-6 below show impacts to two points of diversion for municipal water rights, but these water rights are not approved. Usually, a well is drilled only after the water right is approved. No other existing municipal drinking water sources would be directly affected by the Minimize 4(f) Impacts Alternative.

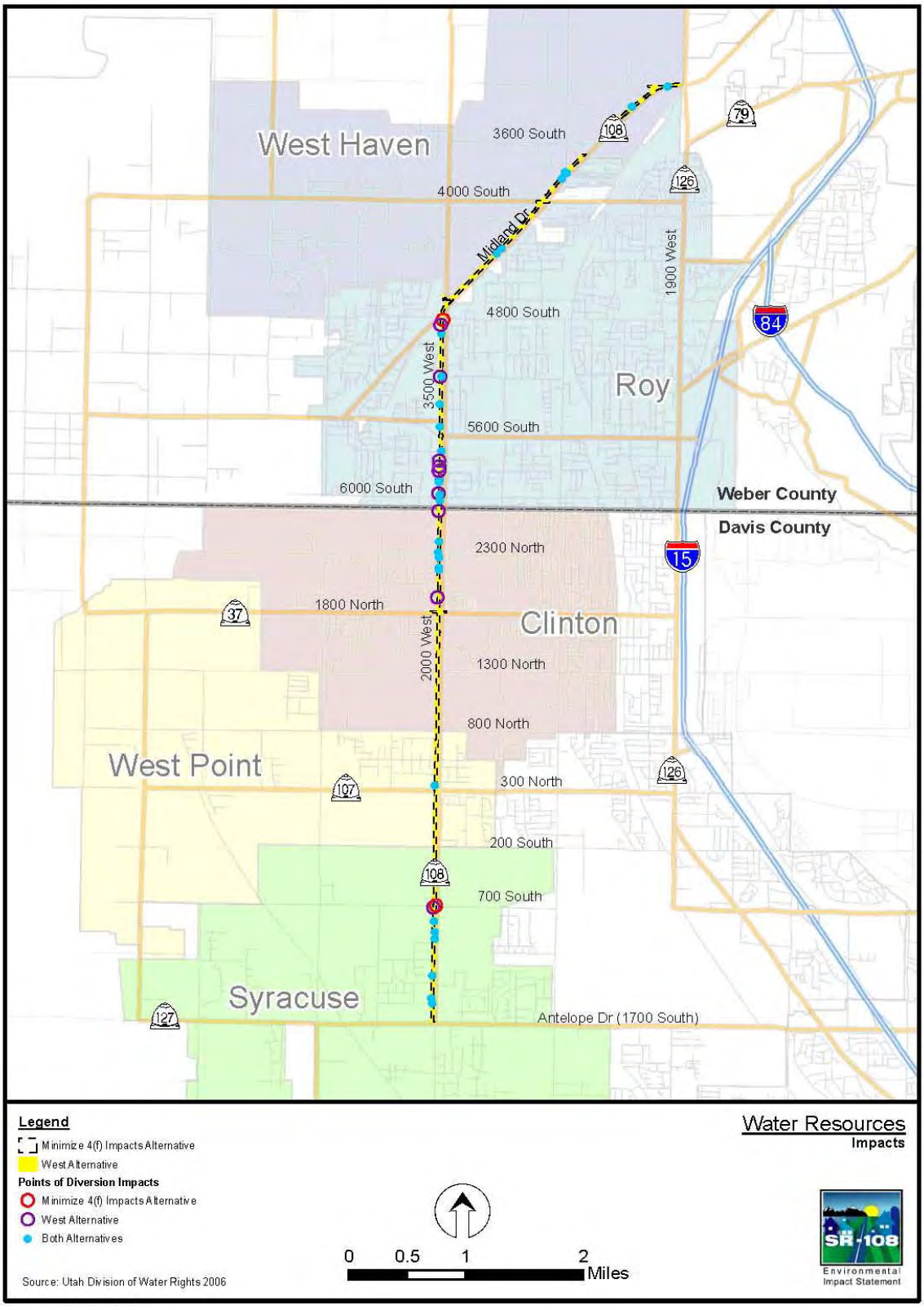
The Minimize 4(f) Impacts Alternative is located about 478 feet east of and up-gradient of the Hooper Water Improvement District's Well #1 and outside of drinking water protection Zone 1 for this well (a 150-foot radius around the well head). No other drinking water wells are both located within about 0.25 mile of the Minimize 4(f) Impacts Alternative and are down-gradient of the alternative. In addition, the source of drinking water in these wells is likely the deep aquifer, which would not be affected by runoff from the Minimize 4(f) Impacts Alternative.

Exhibit 4.11-5: Direct Impacts to Points of Diversion from the Minimize 4(f) Impacts Alternative

Water Right	Use	Source
35-4612	Irrigation and stock watering	Drain water
35-4401	*Unknown*	City of Roy storm drain
35-5813	Irrigation	Land drain system (groundwater)
35-5813	Irrigation	Land drain system (groundwater)
35-5813	Irrigation	Land drain system (groundwater)
31-5227 (unapproved)	Domestic, irrigation, and municipal	Shallow underground water wells
31-5227 (unapproved)	Domestic, irrigation, and municipal	Shallow underground water wells
31-3624	Irrigation	Underground water drain
35-1913	Irrigation	Underground water drain
35-2668	Irrigation	Underground water drain
35-3212	Irrigation and stock watering	Underground water drain
31-2488	Domestic, irrigation, stock watering	Underground water well
31-2763	Domestic and stock watering	Underground water well
31-3225	Domestic and stock watering	Underground water well
31-3228	Domestic and stock watering	Underground water well
31-3231	Domestic	Underground water well
31-3232	Domestic and stock watering	Underground water well
31-3562	Domestic, irrigation, and other	Underground water well
31-3623	Domestic and irrigation	Underground water well
31-3678	Domestic, irrigation, stock watering	Underground water well
31-4702	Irrigation	Underground water well
35-2002	Irrigation	Underground water well
35-2773	Domestic	Underground water well
35-2800	Domestic	Underground water well
35-3308	Irrigation and stock watering	Underground water well
35-3582	Domestic and stock watering	Underground water well
35-3586	Domestic	Underground water well
35-809	Domestic	Underground water well
35-857	Domestic	Underground water well
35-867	Domestic	Underground water well
31-3227	Irrigation	Underground water well
35-2179	Domestic, irrigation, stock watering	Underground water well
35-1306	Irrigation	Underground water drain
35-5661	Domestic and stock watering	Underground water well

The locations of points of diversion were provided by the Utah Division of Water Rights. Because the locations are approximate, the number of wells affected is also an approximation.

Exhibit 4.11-6: Water Resources – Impacts



The exact location of each affected well head or surface water point of diversion would be determined during the final design of the project. The Minimize 4(f) Impacts Alternative could indirectly affect other wells and surface water points of diversion if UDOT needed to acquire a residence or business with an agricultural (irrigation or stock watering) or domestic water source.

4.11.3 West Alternative

The methodology for determining impacts to surface waters from the West Alternative is the same as that used for the Minimize 4(f) Impacts Alternative (see Section 4.11.2.1, Methodology for Determining Impacts to Surface Waters).

4.11.3.1 Impacts to Surface Water

The proposed right-of-way width and the increase in impervious area for the West Alternative would be the same as for the Minimize 4(f) Impacts Alternative, so the impacts to surface water quality and beneficial uses would be the same.

4.11.3.2 Impacts to Groundwater

Groundwater Quality

The proposed right-of-way width and the increase in impervious area for the West Alternative would be the same as for the Minimize 4(f) Impacts Alternative, so the impacts to groundwater quality would be the same.

Groundwater Rights and Wells

The West Alternative would directly affect 40 water rights points of diversion. Three surface water rights, which are storm drain systems, and 37 groundwater rights would be affected. Exhibit 4.11-7 below shows impacts to two municipal water rights, but these wells are not in use. No municipal wells would be directly affected by the West Alternative.

The West Alternative is located 478 feet east of and up-gradient of the Hooper Water Improvement District's Well #1. Because the West Alternative is outside Zone 1 for this well, it would not affect this municipal drinking water source.

Exhibit 4.11-7: Direct Impacts to Points of Diversion from the West Alternative

Water Right	Use	Source
35-105	Irrigation	Drain ditch
35-4612	Irrigation and stock watering	Drain water
35-4401	*Unknown*	City of Roy storm drain
35-5813	Irrigation	Land drain system (groundwater)
35-5813	Irrigation	Land drain system (groundwater)
35-5813	Irrigation	Land drain system (groundwater)
31-5227 (unapproved)	Domestic, irrigation, and municipal	Shallow underground water wells
31-5227 (unapproved)	Domestic, irrigation, and municipal	Shallow underground water wells
31-3624	Irrigation	Underground water drain
35-1913	Irrigation	Underground water drain
35-2668	Irrigation	Underground water drain
35-3212	Irrigation and stock watering	Underground water drain
35-3264	Irrigation and stock watering	Underground water drain
31-2488	Domestic, irrigation, stock watering	Underground water well
31-2679	Stock watering	Underground water well
31-2763	Domestic and stock watering	Underground water well
31-3155	Domestic, irrigation, stock watering	Underground water well
31-3225	Domestic and stock watering	Underground water well
31-3226	Domestic and stock watering	Underground water well
31-3228	Domestic and stock watering	Underground water well
31-3231	Domestic	Underground water well
31-3232	Domestic and stock watering	Underground water well
31-3562	Domestic, irrigation, and other	Underground water well
31-3623	Domestic and irrigation	Underground water well
31-3678	Domestic, irrigation, stock watering	Underground water well
31-4702	Irrigation	Underground water well
35-2001	Domestic, irrigation, stock watering	Underground water well
35-2002	Irrigation	Underground water well
35-2773	Domestic	Underground water well
35-2800	Domestic	Underground water well
35-3308	Irrigation and stock watering	Underground water well
35-3582	Domestic and stock watering	Underground water well
35-3586	Domestic	Underground water well
35-732	Domestic	Underground water well
35-733	Domestic	Underground water well
35-809	Domestic	Underground water well
35-857	Domestic	Underground water well
35-867	Domestic	Underground water well
35-1306	Irrigation	Underground water drain
35-5661	Domestic and stock watering	Underground water well

The locations of points of diversion were provided by the Utah Division of Water Rights. Because the locations are approximate, the number of wells affected is also an approximation.

4.11.4 Mitigation Measures for Water Quality Impacts

4.11.4.1 Mitigation Measures for Water Quality Impacts due to Construction

A UPDES permit will be required if construction disturbs more than 1 acre. This permit will require the use of best management practices (BMPs) to prevent sediments and other contaminants from leaving the construction site.

4.11.4.2 Mitigation Measures for Surface Water Impacts

Detention features will be provided where the capacity of the existing stormwater system is inadequate to convey the additional runoff flows or where the expected impact to the water quality of receiving waters requires flows to be detained and water treated. In addition to reducing peak levels and velocities in streams, detention ponds have the added benefit of reducing contaminant levels of TSS, TDS, and the metals present in highway runoff.

4.11.4.3 Mitigation Measures for Impacts to Wells or Points of Diversion

During the final design of the project, UDOT will work with the property owner to determine the appropriate mitigation measure if a well head or other water right point of diversion is affected. Mitigation could include (1) relocating a well head or surface water diversion to continue to provide irrigation water to any land that is not acquired or (2) abandoning the well and compensating the owner for the value of the associated water right.

4.12 Ecosystem Impacts

This section addresses impacts to bird and wildlife habitat, wildlife, special-status species, and jurisdictional wetlands. Ecosystem impacts were evaluated based on information from several sources, including field surveys along S.R. 108, consultation with USFWS and the Utah Division of Wildlife Resources, and reviews of project aerial maps.

What is the ecosystem impact analysis area?

The ecosystem impact analysis area includes the S.R. 108 project corridor and adjacent areas that could support wildlife that might use the project corridor.

Consultation with USFWS was undertaken to comply with the Endangered Species Act. This Act requires that federally funded projects be evaluated to determine any impacts to federally listed threatened or endangered plant and wildlife species. In addition to meeting this requirement, the potential for impacts to State of Utah sensitive species was also evaluated (see Section 3.12.3.2, State of Utah Sensitive Species).

Field surveys of the S.R. 108 area were conducted in the summer and fall of 2006. These surveys identified and evaluated existing land types, including jurisdictional wetlands, for their potential to provide habitat for wildlife.

Much of the area adjacent to S.R. 108 is urbanized and has typical urban noise levels and activities associated with heavy vehicle traffic and commercial and residential uses. As a result, the action alternatives would affect lands that are for the most part highly developed and urbanized. The existing land types that could be considered as marginal wildlife habitat include the few pastureland and cropland areas and drainages or ditches.

4.12.1 No-Action Alternative

Under the No-Action Alternative, no improvements to S.R. 108 would be made except for routine maintenance, so there would be no direct or indirect impacts to wildlife or wildlife habitat as a result of the project. There would also be no direct or indirect impacts to any threatened, endangered, or State of Utah sensitive species. However, urban development in the impact analysis area will continue to convert the existing and very marginal wildlife habitat into residential and commercial uses. As urbanization continues throughout the impact analysis area, noise levels along S.R. 108 would likely increase. This increased urbanization would likely

result in further degradation of the currently marginal wildlife habitat.

4.12.2 Minimize 4(f) Impacts Alternative

4.12.2.1 Habitat for Fish, Wildlife, and Migratory Birds

The Minimize 4(f) Impacts Alternative would affect only marginal wildlife habitat. These impacts would include the loss of about 26.1 acres of agricultural lands (pasture and crops) and about 88.5 acres of urbanized/disturbed lands (roadways, residential, commercial, and landscaping). The impacts to the various land types are shown in Exhibit 4.12-1.

Exhibit 4.12-1: Impacts to Habitat by Land Type

Shown in acres

Land Type	Minimize 4(f) Impacts Alternative[a]	West Alternative[a]
Pasture	15.4	16.0
Crops	10.7	11.9
Urbanized	88.5	89.3
Disturbed	0.01	0.03
Drainages/ditches[b]	1.0	1.0
Wetlands	0.025	0.025

[a] Because the jurisdictions did not all use the same type of mapping methodology, the acreages presented in this table are an estimate only and do not match the impact acreages presented in Exhibit 3.2-2: Existing Cropland. For example, some jurisdictions apply land use designations to large expanses—including roadways—while others apply designations on a parcel-by-parcel basis and do not include roadways. Acreage estimates for urbanized land include land within and outside the existing right-of-way including the roadway.

[b] Acreages are estimates only. These numbers will be formalized when USACE releases new guidance on the jurisdiction of ditches as waters of the U.S. The acres listed include only those in open ditches and not those within closed structures (such as pipes and culverts).

4.12.2.2 Wildlife

Under the Minimize 4(f) Impacts Alternative, the direct and indirect impacts to wildlife habitat would be minor in the agricultural (pasture and crops) and disturbed land types. Of the two agricultural land types, only pasture has any noteworthy use to wildlife, provided that it has enough structural complexity and diversity of vegetation. Most of the pastures along S.R. 108 do not have the shrubs and trees needed to provide high-value habitat for wildlife. In addition, neither the disturbed land type nor the urbanized land type provides much useful wildlife habitat because these areas are dominated by either weedy and invasive plants or ornamental plants.

What is structural complexity?

With regard to habitat, *structural complexity* refers to the variety of different species of plants in different growth forms (such as grasses, flowering plants, shrubs, and trees) that provides a diversity of habitat types and functions (such as habitat for nesting, hiding, feeding, mating, and resting).

The urban noise levels under this alternative would be similar to those under the No-Action Alternative (see Section 4.10, Noise Impacts), and so the direct and indirect effects to wildlife from noise would be similar for both alternatives.

Irrigation ditches and canals are associated with agricultural lands, and the habitat along some of these ditches and canals could be affected by this alternative. Most of the irrigation ditches and canals in the area are no longer in use and contain a mixture of weedy, upland, and riparian (riverbank) vegetation. However, this vegetation has a low level of structural complexity, which limits the ditches' use by and value for wildlife.

4.12.2.3 Special-Status Species

No threatened or endangered species occur along S.R. 108. The only species that occurs near S.R. 108 is the threatened bald eagle (*Haliaeetus leucocephalus*). There would be no direct or indirect impacts to the bald eagle from the Minimize 4(f) Impacts Alternative. There are no known migratory roosts for bald eagles along S.R. 108. Although cottonwood snags (upright dead trees) along S.R. 108 could be used by the eagles as temporary perches, such snags are common throughout the area. The removal of snags by construction crews would not affect eagles' ability to find a temporary perch.

In addition, there would be no direct or indirect impacts to State of Utah sensitive species (species of special concern or conservation species). There is no habitat for sensitive species in the impact

analysis area, nor are there occurrences of any sensitive species in this area.

4.12.2.4 Waters of the U.S.

Wetlands. Under the Minimize 4(f) Impacts Alternative, there would be 0.025 acre affected from the 0.36-acre wetland on the southwest corner of the S.R. 108/1900 West intersection. There would be no impact to the 0.05-acre wetland northeast of the Midland Drive/4800 South intersection along S.R. 108. Given that both wetlands are small and isolated, their value to wildlife is likely minor. Both wetlands are along the right-of-way where increased runoff during construction could degrade the water quality. However, temporary construction measures such as environmental fencing and silt fencing, along with permanent structures for controlling roadway runoff, would avoid any negative water quality impacts.

Drainages and Canals. The jurisdictional wetland determination for the S.R. 108 project is being reviewed by USACE. The following paragraphs discuss impacts to drainages and canals in the event that they are determined to be waters of the U.S. UDOT will continue to coordinate with the USACE regarding the jurisdictional determination and any necessary mitigation.

The impacts to any jurisdictional drainages or canals would be minor. The primary use of the area has historically been agriculture, so the area has many ditches and irrigation canals. Although a few of these ditches and canals are still used by landowners for crop irrigation and are relatively free of vegetation, most are no longer used. Some of these ditches run parallel to S.R. 108, and others cross under S.R. 108. Most are now in closed systems with no outlet to any waters of the U.S.

Some of these small ditches might drain to the Layton Canal and eventually to the Great Salt Lake, which is a water of the U.S., and therefore might be considered waters of the U.S. under USACE's new guidance. About 1 acre of these potentially jurisdictional ditches would be removed to accommodate the alternative.

For the ditches and canals that cross under S.R. 108, the impacts from the alternative on these crossings would involve extending the culverts on one or both ends to accommodate the wider roadway. For

What are waters of the U.S.?

Under the Clean Water Act, *waters of the U.S.* are defined as waters that are navigable waters, those that are interstate waters, and/or those used for interstate commerce, their tributaries, and their associated wetlands. Waters of the U.S. are under the jurisdiction of USACE, so they are sometimes referred to as *jurisdictional waters*.

USACE has jurisdiction over most wetlands, but some wetlands are not considered jurisdictional. A wetland that is not navigable and is not used for interstate commerce or otherwise does not fit the definition of a water of the U.S. would not qualify as a jurisdictional wetland. This type of wetland is called an *isolated wetland*.

the small ditches that run parallel to S.R. 108 and would be affected by roadway widening, about 1 acre of these ditches would be removed to accommodate the alternative.

Prior to construction, USACE would determine whether these drainages and canals are waters of the U.S. based on its future guidance. If USACE determines that the canals are waters of the U.S., the appropriate Section 404 permit under the Clean Water Act would be obtained. Given the small amount of expected impacts to the existing canal system, it is likely that the alternative could be permitted under a nationwide permit.

4.12.3 West Alternative

4.12.3.1 Habitat for Fish, Wildlife, and Migratory Birds

The West Alternative would affect only poor wildlife habitat in the amount of about 27.9 acres of agricultural lands (pasture and crops), about 89.3 acres of disturbed lands (urbanized and disturbed areas), and no wetlands. The impacts to habitat by land type are shown in Exhibit 4.12-1: Impacts to Habitat by Land Type above.

4.12.3.2 Wildlife

The direct and indirect impacts to wildlife and wildlife habitat under the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

4.12.3.3 Special-Status Species

The impacts to threatened and endangered species under the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

4.12.3.4 Waters of the U.S.

The direct and indirect impacts to waters of the U.S. under the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

4.12.4 Mitigation Measures for Ecosystems Impacts

To mitigate any construction impacts to the small, isolated jurisdictional wetland, appropriate BMPs will be incorporated into the construction plan. Environmental fencing will be installed to prevent construction equipment impacts, along with installing silt fencing to control sedimentation of the wetland. Any mitigation to the 0.025 acre of wetlands and the ditches parallel to the alignment will depend on the jurisdictional status and the type of permit requested as determined by USACE. However, no mitigation is anticipated for impacts to the ditches. No mitigation will be required for impacts to disturbed or urbanized lands.

4.13 Floodplain Impacts

There are no designated floodplains in the S.R. 108 study area, so there would be no impacts to floodplains.

4.14 Impacts to Historic, Archaeological, and Paleontological Resources

This section provides an overview of the expected impacts to historic, archaeological, and paleontological resources from the No-Action and action alternatives. Based on the cultural resources inventory, the S.R. 108 project would affect architectural properties only.

What is the impact analysis area for cultural resources?

The impact analysis area for the cultural resources analysis is the area likely to be directly or indirectly affected by the proposed alternatives.

4.14.1 Definition of Section 106 Impacts

Impacts to architectural properties from the action alternatives were documented using the Section 106 guidelines in 36 CFR 800.5. These impacts are described as No Effect, No Adverse Effect, or Adverse Effect. These degrees of effects can be considered under Section 4(f) when determining the appropriateness of avoidance alternatives. The types of impacts from the action alternatives were documented by FHWA and UDOT in the Determination of Eligibility and Finding of Effect (see Appendix B, Determination of Eligibility and Finding of Effect and Native American Consultation). The definitions of these impacts are as follows:

- **No Effect.** A No Effect determination is made when the alternative has no impact (direct or indirect) on the character, use, or historic qualities of an architectural property or archaeological site.
- **No Adverse Effect.** A No Adverse Effect determination is made when the alternative affects the minor aspects of the character, use, or historic qualities of an architectural property or archaeological site, but the property or site retains its essential historic characteristics.
- **Adverse Effect.** An Adverse Effect occurs when the alternative affects the essential character, use, or qualities of an architectural property or archaeological site.

4.14.2 Methodology for Architectural Property Impacts

For the purpose of determining impacts to historic properties, appropriate historic boundaries must be established for each eligible property within the project's area of potential effect. National Register Bulletin 21, *Defining Boundaries for National Register Properties* (Siefert 1995), offers guidance on how to establish such boundaries. The bulletin cautions researchers to "remember that many buildings have associated contributing landscape and archaeological features" and to "consider these resources as well as the architectural resources when selecting boundaries and evaluating significance of buildings." The bulletin offers the following recommendations for defining property boundaries for architectural properties:

- Select boundaries that encompass the entire resource, including both historic and modern additions. Include surrounding land historically associated with the resource that retains integrity and contributes to the property's historic significance.
- Use the legally recorded parcel number or lot lines for urban and suburban properties that retain their historic boundaries and integrity.
- For small rural properties, select boundaries that encompass significant resources, including outbuildings and the associated setting.
- For larger rural properties, select boundaries that include fields, forests, and open range land that is historically associated with the property and conveys the property's historic setting. The areas included must have integrity and contribute to the property's historic significance.

Historic properties along S.R. 108 are almost entirely suburban or rural in nature. For most historic buildings, the majority of which were constructed during the early to middle 20th century, the current legal property boundaries represent the original historic property boundaries. For this reason, the current legal property boundaries were used to define the boundaries of most of the eligible historic architectural properties along S.R. 108. In rare instances, the current legal property boundaries either do not reflect the historic boundaries

What are historic resources, archaeological resources, and paleontological resources?

*Historic resource*s are architectural properties such as buildings. *Archaeological resources* are sites, features, and structures composed primarily of non-architectural elements. *Paleontological resources* are fossil resources.

What is the National Register of Historic Places?

The *National Register of Historic Places*, or NRHP, is a listing of archaeological sites, buildings, and structures throughout the United States that have undergone thorough documentation and rigorous evaluation and have been determined to be important in local, national, or international prehistory or history.

or no longer contribute to the primary building's overall integrity. With these factors in mind, appropriate boundaries were identified for each eligible primary structure documented during the reconnaissance-level survey.

4.14.3 No-Action Alternative

Under the No-Action Alternative, no physical changes would be made to S.R. 108. No impacts to historic, archaeological, or paleontological resources would occur as a result of the S.R. 108 project. The transportation projects identified in other agency long-range plans and by the local communities would be constructed, and these projects could cause impacts to historic, archaeological, or paleontological resources.

Additionally, private development will continue to result in the demolition of historic buildings to accommodate modern structures, and private landowners will continue to modify their historic residences with such actions as applying modern exterior treatments (such as aluminum or vinyl siding or stucco), replacing historic windows, and constructing modern additions. Finally, as non-transportation development continues in the area, historic features such as open irrigation ditches will be enclosed or piped.

4.14.4 Minimize 4(f) Impacts Alternative

4.14.4.1 Historic Architectural Properties

The Minimize 4(f) Impacts Alternative would have a long-term adverse effect on 14 of the 61 NRHP-eligible architectural properties along S.R. 108. This alternative would have no adverse effect on 40 of the 61 architectural resources and would entirely avoid five properties. (Two additional properties would not be affected as part of this project.) Exhibit 4.14-1 below summarizes the impacts to NRHP-eligible architectural properties from this alternative. Shaded rows indicate properties that would be adversely affected.

Exhibit 4.14-1: Impacts to NRHP-Eligible Historic and Archaeological Resources from the Minimize 4(f) Impacts Alternative

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
1663 South 2000 West, Syracuse	1-part commercial block exhibiting a combination of early and late 20th-century style	A	Direct impact to historic building; Adverse Effect
1609 South 2000 West, Syracuse	Foursquare residence of general Bungalow style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
?1451 South 2000 West, Syracuse	1-part block vernacular service station	C	Minor impact from cut/fill; No Adverse Effect
1419 South 2000 West, Syracuse	Vernacular Minimal Traditional residence of undefined type	C	Minor impact from cut/fill; No Adverse Effect[b]
1401 South 2000 West, Syracuse	Residence of undefined type and vernacular style with some Minimal Traditional elements; historical tree line about 7 feet from existing curb and historical fence about 20 feet from curb	C	Minor impact from cut/fill; No Adverse Effect
1373 South 2000 West, Syracuse	Ranch/Rambler residence of vernacular Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1317 South 2000 West, Syracuse	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
1217 South 2000 West, Syracuse	Foursquare residence of mixed Bungalow and general Victorian style; historical tree line about 12 feet from existing curb	C	Minor impact from cut/fill; No Adverse Effect
1189 South 2000 West, Syracuse	Vernacular Ranch/Rambler residence of general Ranch/Rambler and Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
1147 South 2000 West, Syracuse	Vernacular Ranch/Rambler residence of general Ranch/Rambler style; historical trees about 12 feet from existing edge of pavement	C	Minor impact from cut/fill; No Adverse Effect
1133 South 2000 West, Syracuse	Period Cottage of Greek Revival and general Period Revival style; small, historical ditch along north edge of property	C	Minor impact from cut/fill; No Adverse Effect
963 South 2000 West, Syracuse	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
850 South 2000 West, Syracuse	Utah Onions warehouse of early 20th-century style	C	Direct impact to historic building; Adverse Effect
723 South 2000 West, Syracuse	Cross-wing (T-cottage) of general Victorian style	C	Direct impact to historic building; Adverse Effect
150 South 2000 West, West Point	World War II (WWII)-Era Cottage with general Ranch/Rambler style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
145 South 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler and Post-WWII style	C	No impact; No Effect
58 South 2000 West, West Point	Period Cottage of general Period Revival style; clad in striated brick	C	Direct impact to historic building; Adverse Effect

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
39 South 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
?20 North 2000 West, West Point (agricultural outbuilding complex only)	Agricultural outbuilding complex consisting of a block-and-wing Monitor-style barn and two lean-to sheds	C	Minor impact from cut/fill; No Adverse Effect
310 North 2000 West, West Point	Ranch/Rambler residence of Ranch/ Rambler and Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
647 North 2000 West, West Point	WWII-Era Cottage of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect
667 North 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
796 North 2000 West, West Point	WWII-Era Cottage of vernacular style	C	Direct impact to historic building; Adverse Effect
817 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
868 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII and Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
881 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch/ Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1071 North 2000 West, Clinton	Hall-Parlor or Single Cell residence of early 20th-century style	C	Minor impact from cut/fill; No Adverse Effect
1141 North 2000 West, Clinton	Early Ranch/Rambler residence of Early Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1197 North 2000 West, Clinton	Duplex of general Ranch/Rambler style; historical ditch running along the property frontage about 10 feet from the existing edge of pavement for S.R. 108	C	Direct impact to historic ditch (contributing feature); Adverse Effect
1253 North 2000 West, Clinton	WWII-Era Cottage of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1318 North 2000 West, Clinton	Period Cottage of the English Cottage style; probable historical tree in front yard near house and probable historical ditch along the west edge of the associated agricultural field to the north of the residence	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
1693 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
1969 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1993 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
2133 North 2000 West, Clinton	Bungalow residence of general Bungalow and Arts & Crafts styles	C	Direct impact to historic building; Adverse Effect
2162 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
2184 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
2212 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch Rambler and Contemporary style	C	No impact; No Effect
2282 North 2000 West, Clinton	Residence of undefined type and general Post-WWII/Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
1988 West 2300 North, Clinton	Period Cottage of Greek Revival style; clad in stucco	C	Minor impact from cut/fill; No Adverse Effect
2342 North 2000 West, Clinton	Modified (simplified) Cape Cod vernacular residence	C	Minor impact from cut/fill; No Adverse Effect
2404 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch style	C.	Minor impact from cut/fill; No Adverse Effect
2422 North 2000 West, Clinton	Ranch/Rambler residence of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect
2541 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect
5986 South 2000 West, Roy	WWII-Era Cottage of general Minimal Traditional style	C	Minor impact from cut/fill; No Adverse Effect
5939 South 3500 West, Roy	Ranch/Rambler residence of general Ranch/Rambler Style	C	Minor impact from cut/fill; No Adverse Effect
5867 South 3500 West, Roy	Ranch/Rambler of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
5844 South 3500 West, Roy	WWII-Era Cottage of general Minimal Traditional and Period Revival style; probable historical trees within 15 feet of the existing curb	C	Minor impact from cut/fill; No Adverse Effect
5839 South 3500 West, Roy	Residence of undefined type and Contemporary style; possible historical retaining wall about 15 feet from the existing edge of pavement of S.R. 108	C	Minor impact from cut/fill; No Adverse Effect
5823 South 3500 West, Roy	Ranch/Rambler residence of Ranch/ Rambler and Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
5720 South 3500 West, Roy	Contemporary type and style residence	C	Direct impact to historic building; Adverse Effect
4180 Midland Drive, West Haven	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Effect
4148 Midland Drive, West Haven	Bungalow residence of general Bungalow style; antique Jackson-Perkins test roses along property frontage	A and C	No impact; No Effect
3982 Midland Drive, West Haven	Ranch/Rambler residence (with attached garage) of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
3964 Midland Drive, West Haven	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
3801 Midland Drive, West Haven	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
3713 Midland Drive, West Haven (outbuildings only)	Agricultural outbuildings only; primary outbuilding is a shed or possible milking barn	C	Direct impact to primary historic outbuilding; Adverse Effect
3594 Midland Drive, West Haven	WWII-Era Cottage of general Post-WWII style; probable historical landscaping 40 to 50 feet from existing pavement of S.R. 108	C	NA[c]

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
3575 Midland Drive, West Haven (outbuilding only)	Outbuilding only; historical tree line about 20 feet from existing edge of pavement	C	NA[c]
3478 Midland Drive, West Haven	Ranch/Rambler residence of general Post-WWII style	C	No impact; No Effect
2008 West 3300 South, West Haven	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
Site 42Wb352	Denver & Rio Grande Western Railroad	A	No impact; No Effect

Shaded rows indicate properties that would be adversely affected.

[a] A "?" in front of an address means the address is estimated.

[b] A strip take is assessed as No Adverse Effect if no NRHP-eligible historic buildings or contributing features would be affected.

[c] The impact to this property was evaluated under the UDOT Hinckley Drive Extension project.

The adverse effects to historic architectural properties from the Minimize 4(f) Impacts Alternative would be greater than those from the No-Action Alternative but less than those from the West Alternative.

4.14.4.2 Archaeological Sites

One archaeological site identified along S.R. 108 was determined to be eligible for the NRHP. This is Site 42Wb352, the Denver & Rio Grande Western Railroad, located at the intersection of S.R. 108 and S.R. 126. The Minimize 4(f) Impacts Alternative would avoid this site.

4.14.4.3 Traditional Cultural Properties

No known traditional cultural properties would be affected by this alternative.

4.14.4.4 Paleontological Resources

No known paleontological resources would be affected by this alternative.

4.14.5 West Alternative

4.14.5.1 Historic Architectural Properties

The West Alternative would have a long-term adverse effect on 22 of the 61 NRHP-eligible historic architectural properties along S.R. 108. This alternative would have no adverse effect on 33 of the 61 resources and would entirely avoid four properties. (Two additional properties would not be affected as part of this project.) Exhibit 4.14-2 summarizes the impacts to NRHP-eligible architectural resources from this alternative. Shaded rows indicate properties that would be adversely affected.

Exhibit 4.14-2: Impacts to NRHP-Eligible Historic and Archaeological Resources from the West Alternative

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
1663 South 2000 West, Syracuse	1-part commercial block exhibiting a combination of early and late 20th-century style	A	Direct impact to historic building; Adverse Effect
1609 South 2000 West, Syracuse	Foursquare residence of general Bungalow style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
?1451 South 2000 West, Syracuse	1-part block vernacular service station	C	Minor impact from cut/fill; No Adverse Effect[b]
1419 South 2000 West, Syracuse	Vernacular Minimal Traditional residence of undefined type	C	Minor impact from cut/fill; No Adverse Effect
1401 South 2000 West, Syracuse	Residence of undefined type and vernacular style with some Minimal Traditional elements; historical tree line about 7 feet from existing curb and historical fence about 20 feet from curb	C	Minor impact from cut/fill; No Adverse Effect
1373 South 2000 West, Syracuse	Ranch/Rambler residence of vernacular Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
1317 South 2000 West, Syracuse	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
1217 South 2000 West, Syracuse	Foursquare residence of mixed Bungalow and general Victorian style; historical tree line about 12 feet from existing curb	C	Minor impact from cut/fill; No Adverse Effect
1189 South 2000 West, Syracuse	Vernacular Ranch/Rambler residence of general Ranch/Rambler and Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
1147 South 2000 West, Syracuse	Vernacular Ranch/Rambler residence of general Ranch/Rambler style; historical trees about 12 feet from existing edge of pavement	C	Minor impact from cut/fill; No Adverse Effect

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
1133 South 2000 West, Syracuse	Period Cottage of Greek Revival and general Period Revival style; small, historical ditch along north edge of property	C	Minor impact from cut/fill; No Adverse Effect
963 South 2000 West, Syracuse	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
850 South 2000 West, Syracuse	Utah Onions warehouse of early 20th-century style	C	Direct impact to historic building; Adverse Effect
723 South 2000 West, Syracuse	Cross-wing (T-cottage) of general Victorian style	C	Minor impact from cut/fill; No Adverse Effect
150 South 2000 West, West Point	WWII-Era Cottage with general Ranch/ Rambler style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
145 South 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler and Post-WWII style	C.	No impact; No Adverse Effect
58 South 2000 West, West Point	Period Cottage of general Period Revival style; clad in striated brick	C	Direct impact to historic building; Adverse Effect
39 South 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
?20 North 2000 West, West Point (agricultural outbuilding complex only)	Agricultural outbuilding complex consisting of a block-and-wing Monitor-style barn and two lean-to sheds	C	Minor impact from cut/fill; No Adverse Effect
310 North 2000 West, West Point	Ranch/Rambler residence of Ranch/ Rambler and Contemporary style	C	Minor impact from cut/fill for intersection; No Adverse Effect
647 North 2000 West, West Point	WWII-Era Cottage of general Post-WWII style	C	Direct impact to historic building; Adverse Effect
667 North 2000 West, West Point	Ranch/Rambler residence of general Ranch/Rambler style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
796 North 2000 West, West Point	WWII-Era Cottage of vernacular style	C	Direct impact to historic building; Adverse Effect
817 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Direct impact to historic building; Adverse Effect
868 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII and Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
881 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch/Rambler style	C	Direct impact to historic building; Adverse Effect
1071 North 2000 West, Clinton	Hall-Parlor or Single Cell residence of early 20th-century style	C	Direct impact to historic building; Adverse Effect
1141 North 2000 West, Clinton	Early Ranch/Rambler residence of Early Ranch/Rambler style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
1197 North 2000 West, Clinton	Duplex of general Ranch/Rambler style; historical ditch running along the property frontage about 10 feet from the existing edge of pavement for S.R. 108	C	Direct impact to historic building; Adverse Effect
1253 North 2000 West, Clinton	WWII-Era Cottage of general Ranch/ Rambler style	C	Direct impact to historic building; Adverse Effect

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
1318 North 2000 West, Clinton	Period Cottage of the English Cottage style; probable historical tree in front yard near house and probable historical ditch along the west edge of the associated agricultural field to the north of the residence	C	No impact; No Effect
1693 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch style	C	Direct impact to historic building; Adverse Effect
1969 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Direct impact to historic building; Adverse Effect
1993 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Direct impact to historic building; Adverse Effect
2133 North 2000 West, Clinton	Bungalow residence of general Bungalow and Arts & Crafts styles	C	Direct impact to historic building; Adverse Effect
2162 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
2184 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect
2212 North 2000 West, Clinton	Ranch/Rambler residence of general Ranch Rambler and Contemporary style	C	No impact; No Effect
2282 North 2000 West, Clinton	Residence of undefined type and general Post-WWII/Contemporary style	C	Minor impact from cut/fill; No Adverse Effect
1988 West 2300 North, Clinton	Period Cottage of Greek Revival style; clad in stucco	C	Minor impact from cut/fill; No Adverse Effect
2342 North 2000 West, Clinton	Modified (simplified) Cape Cod vernacular residence	C	Minor impact from cut/fill; No Adverse Effect
2404 North 2000 West, Clinton	Early Ranch/Rambler of Early Ranch style	C	Minor impact from cut/fill; No Adverse Effect
2422 North 2000 West, Clinton	Ranch/Rambler residence of general Post-WWII style	C	Minor impact from cut/fill; No Adverse Effect
2541 North 2000 West, Clinton	WWII-Era Cottage of general Post-WWII style	C	Direct impact to historic building; Adverse Effect
5986 South 2000 West, Roy	WWII-Era Cottage of general Minimal Traditional style	C	Minor impact from cut/fill; No Adverse Effect
5939 South 3500 West, Roy	Ranch/Rambler residence of general Ranch/Rambler Style	C	Minor impact from cut/fill; No Adverse Effect
5867 South 3500 West, Roy	Ranch/Rambler of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
5844 South 3500 West, Roy	WWII-Era Cottage of general Minimal Traditional and Period Revival style; probable historical trees within 15 feet of the existing curb	C	Minor impact from cut/fill; No Adverse Effect
5839 South 3500 West, Roy	Residence of undefined type and Contemporary style; possible historical retaining wall about 15 feet from the existing edge of pavement of S.R. 108	C	Probable historic retaining wall (contributing feature) removed; Adverse Effect
5823 South 3500 West, Roy	Ranch/Rambler residence of Ranch/ Rambler and Contemporary style	C	Minor impact from cut/fill; No Adverse Effect

Address or Site[a]	Description	NRHP Eligibility Criterion	Nature of Impact
5720 South 3500 West, Ro y	Contemporary type and style residence	C	Minor impact from cut/fill; No Adverse Effect
4180 Midland Drive, West Haven	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
4148 Midland Drive, West Haven	Bungalow residence of general Bungalow style; antique Jackson-Perkins test roses along property frontage	A and C	Minor impact from cut/fill; No Adverse Effect
3982 Midland Drive, West Haven	Ranch/Rambler residence (with attached garage) of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
3964 Midland Drive, West Haven	Ranch/Rambler residence of general Ranch/Rambler style	C	Minor impact from cut/fill; No Adverse Effect
3801 Midland Drive, West Haven	Ranch/Rambler residence of general Ranch/Rambler style	C	Substantive impact from cut/fill; possible removal of primary historic building; Adverse Effect
3713 Midland Drive, West Haven (outbuildings only)	Agricultural outbuildings only; primary outbuilding is a shed or possible milking barn	C	Direct impact to historic building; Adverse Effect
3594 Midland Drive, West Haven	WWII-Era Cottage of general Post-WWII style; probable historical landscaping 40 to 50 feet from existing pavement of S.R. 108	C	NA[c]
3575 Midland Drive, West Haven (outbuilding only)	Outbuilding only; historical tree line about 20 feet from existing edge of pavement	C	NA[c]
3478 Midland Drive, West Haven	Ranch/Rambler residence of general Post-WWII style	C	No impact; No Effect
2008 West 3300 South, West Haven	Bungalow residence of general Bungalow style	C	Minor impact from cut/fill; No Adverse Effect
Site 42Wb352	Denver & Rio Grande Western Railroad	A	No impact; No Effect

Shaded rows indicate properties that would be adversely affected.

[a] A "?" in front of an address means the address is estimated.

[b] A strip take is assessed as No Adverse Effect if no NRHP-eligible historic buildings or contributing features would be affected.

[c] This property is within the area of potential effect where S.R. 108 intersects Hinckley Drive. Impacts to this property were evaluated under the UDOT Hinckley Drive Extension project, which will be constructed first. The S.R. 108 project would have no additional impacts to this property.

The adverse impacts to historic architectural properties from the West Alternative would be greater than those from either the No-Action Alternative or the Minimize 4(f) Impacts Alternative.

4.14.5.2 Archaeological Sites

One archaeological site identified along S.R. 108 was determined to be eligible for the NRHP. This is Site 42Wb352, the Denver & Rio Grande Western Railroad, located at the intersection of S.R. 108 and S.R. 126. The West Alternative would avoid this site.

4.14.5.3 Traditional Cultural Properties

No known traditional cultural properties would be affected by this alternative.

4.14.5.4 Paleontological Resources

No known paleontological resources would be affected by this alternative.

4.14.6 Mitigation Measures for Impacts to Historic, Archaeological, and Paleontological Resources

Mitigation measures for adverse effects to historic buildings will be necessary under either action alternative. The exact mitigation measures would be negotiated between FHWA, UDOT, the Utah SHPO, and interested parties through the Section 106 process of the National Historic Preservation Act. These measures would be determined by historic protection experts to mitigate the impacts to these resources to the greatest extent feasible. A Memorandum of Agreement has been developed between FHWA and the Utah SHPO (UDOT is an invited signatory) outlining the specific mitigation measures to be implemented if an action alternative is selected in the Record of Decision for the project. The Memorandum of Agreement (see Appendix B, Determination of Eligibility and Finding of Effect and Native American Consultation) states that adverse impacts to historic properties will include a Utah State Intensive-Level Survey (ILS) in advance of construction activities. Submittals will include ILS forms and photographs according to SHPO standards.

In accordance with 36 CFR 800.13(b), UDOT and FHWA are providing for the protection, evaluation, and treatment of any historic property discovered prior to or during construction. UDOT Standard Specifications Section 01355, Part 1.13, Discovery of Historical, Archaeological, or Paleontological Objects, Features, Sites, Human Remains, or Migratory Avian Species, will be enforced during this project. This specification stipulates procedures to be followed if any archaeological, historic, or paleontological resources and/or human remains are discovered during construction of the project. See Appendix B for a more detailed discussion of the stipulations outlined in the Memorandum of Agreement.

4.15 Impacts to Hazardous Waste Sites

Section 3.15, Hazardous Waste Sites, identifies the potentially hazardous sites in the hazardous waste impact analysis area. This section discusses the expected impacts of the No-Action and action alternatives on known and potential hazardous waste sites in the hazardous waste impact analysis area (see Exhibit 3.15-2, Potential Hazardous Waste Sites of Greatest Concern within One-Half Mile of S.R. 108).

What is the hazardous waste impact analysis area?

The hazardous waste impact analysis area is the area within one-half mile of each side of the existing S.R. 108 centerline.

The first step in evaluating hazardous waste sites of concern was to categorize the types of sites identified in the impact analysis area by the relative likelihood of finding contamination. The second step was to conduct a "windshield" (drive-through) survey to validate the site locations of hazardous waste sites. Sites were categorized as having a high, moderate, or low probability of environmental degradation. For more information about this process and the types of hazardous waste sites, see Section 3.15, Hazardous Waste Sites.

High Probability of Environmental Degradation. The following sites have a high probability of existing soil or groundwater contamination:

- Open LUST sites

Moderate Probability of Environmental Degradation. The following sites have a moderate probability of environmental degradation:

- Closed LUST sites
- Active UST sites

Low Probability of Environmental Degradation. The following sites have a low probability of environmental degradation:

- Removed and closed USTs
- AST sites
- FINDS sites

4.15.1 No-Action Alternative

Under the No-Action Alternative, no improvements to S.R. 108 would be made except for routine maintenance. Therefore, no impacts or disturbances to potentially hazardous waste sites would occur from the S.R. 108 improvements. However, continued development adjacent to S.R. 108 could disturb some sites.

4.15.2 Minimize 4(f) Impacts Alternative

4.15.2.1 Known Sites

Patterson Farms (LUST, UST; 1613 West 2300 North, Clinton)

The Minimize 4(f) Impacts Alternative would not affect the Patterson Farms property. All LUSTs and USTs at this site are currently closed (DERR 2007). Patterson Farms has been sold to a developer, and it is assumed that the tanks will be removed as the property is developed (HDR 2007).

Old Farm Market – Now Maverik #340 (UST, FINDS; 5511 South 3500 West, Roy)

The Minimize 4(f) Impacts Alternative would require a strip take of about 3,443 square feet of this property. The gas pumps and three associated USTs at this site are currently in use (DERR 2007). The close proximity of this site to S.R. 108 and the potential relocation of the pumps and underground storage tanks make this property a site of concern. UDOT is aware of possible soil contamination and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this facility.

Syracuse Junior High School (FINDS; 1450 South 2000 West, Syracuse)

The Minimize 4(f) Impacts Alternative would require a strip take of about 39,650 square feet of the parking lot of Syracuse Junior High School. The building itself would not be affected. No chemical or fuel storage areas were noted in the location of the strip take, so the potential for impacts from hazardous materials is low (HDR 2007).

Triple Stop Phillips 66 (UST, LUST; 4795 South 3500 West, Roy)

The Minimize 4(f) Impacts Alternative would require the relocation of this facility due to a take of about 5,444 square feet of this property. Gas pumps and associated USTs are in use. A LUST occurrence was reported at this facility and is currently being monitored on a quarterly basis by DERR (Beery 2007). Although the LUST is located outside the right-of-way for this alternative, construction workers could encounter petroleum-based contamination that has migrated into the right-of-way. Because this site is up-gradient of S.R. 108 (that is, groundwater is assumed to flow east to west through this site toward S.R. 108), this site is noted as a site of concern. UDOT is aware that the right-of-way could be contaminated and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this facility. UDOT will check the site status before construction and coordinate with DERR to determine what remedial procedures are required.

What is a hydraulic gradient?

A *hydraulic gradient* is the slope of the water table or aquifer. The hydraulic gradient influences the direction and rate of groundwater flow. If an alternative is down-gradient from a hazardous waste site, then groundwater likely flows from the site in the direction of the alternative.

Dee's Service (LUST, UST, FINDS; 1793 North 2000 West, Clinton)

The Minimize 4(f) Impacts Alternative would require a strip take of about 2,464 square feet of this property. The service station is closed. LUSTs and USTs were documented at the site; these LUST and UST cases have been closed and the tanks have been removed (DERR 2007). If contaminated soil or groundwater remains at the site, it could be encountered during construction. UDOT is aware of possible residual soil contamination at this site and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this property.

CH Dredge and Co. – Now SCI (LUST, UST, AST; 918 South 2000 West, Syracuse)

The Minimize 4(f) Impacts Alternative would require a strip take of about 12,496 square feet of this property. The LUST and UST cases at this site have been closed, and the tanks have been removed (DERR 2007). During a field survey, an AST was noted in the rear parking lot between SCI and Utah Onions. If contaminated soil or

groundwater remain at the site, they could be encountered during construction. UDOT is aware of possible soil contamination and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this facility.

Utah Onions, Inc. (UST, FINDS; 850 South 2000 West, Syracuse)

The Minimize 4(f) Impacts Alternative would require the relocation of the Utah Onions facility due to a take of about 5,177 square feet of this property. The front of the building and an existing overhead power line would be taken by this alternative. A UST located at this facility was removed (DERR 2007). An AST was noted in the parking lot between Utah Onions and SCI (HDR 2007). However, the potential for this AST to contaminate the site is low because a leaking AST is more easily detected than a leaking UST and remedial measures can be taken more quickly. UDOT is aware of the potential to encounter soil contamination at this site and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this facility.

Midland Market – Now Sinclair Gas (UST; 3805 S. Midland Drive, West Haven)

The Minimize 4(f) Impacts Alternative would require a strip take of about 3,617 square feet of this property. Gas pumps and associated USTs at this site are currently in use (DERR 2007). Because a pump station and USTs might need to be relocated, and because this site is up-gradient of S.R. 108 (that is, groundwater is assumed to flow through this site toward S.R. 108), this site is noted as a site of concern. If contaminated soil or groundwater remains at the site, it could be encountered during construction. UDOT is aware of possible soil contamination at this site and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this facility.

4.15.2.2 Undocumented Sites

During a field survey, three undocumented facilities (sites that were not identified in the databases searched) were noted as having a potential to contain hazardous materials. The locations of these facilities are approximate.

Clinton Nursery (1071 North 2000 West, Clinton)

At the time of the hazardous waste site analysis, this site was not documented in any hazardous material database maintained by DERR or EPA. A gasoline AST with secondary containment and a pumping structure were noted on the property (HDR 2007). The Minimize 4(f) Impacts Alternative would likely take part of the parking lot in front of the building. If contamination is present, it could be petroleum-, pesticide-, or herbicide-based. UDOT is aware of the potential to encounter soil contamination at this site and would take appropriate steps to prevent construction workers from being exposed to or spreading hazardous chemicals when working near this property.

Unnamed Storage Yard (about 868 North 2000 West, Clinton)

This site is a storage yard with farm equipment and miscellaneous small mobile chemical storage tanks (HDR 2007). Construction workers could encounter contamination at this site in the form of fertilizers, herbicides, or pesticides.

Unnamed Construction Yard (2117 West 3300 South, Ogden)

This site is a construction company yard that contains equipment and an AST pump (HDR 2007). If contamination is present, it could be encountered during construction.

4.15.3 West Alternative

4.15.3.1 Known Sites

Patterson Farms (LUST, UST; 1613 West 2300 North, Clinton)

The impacts to Patterson Farms from the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

Old Farm Market – Now Maverik #340 (UST, FINDS; 5511 South 3500 West, Roy)

The West Alternative would require a strip take of about 304 square feet of this property. The amount of property acquired would be less than that for the Minimize 4(f) Impacts Alternative, but all other impacts would be the same as those from the Minimize 4(f) Impacts Alternative.

Syracuse Junior High School (FINDS; 1450 South 2000 West, Syracuse)

The West Alternative would require a strip take of about 38,650 square feet of the parking lot of Syracuse Junior High School, slightly less than what would be required under the Minimize 4(f) Impacts Alternative. No other impacts are expected.

Triple Stop Phillips 66 (LUST, UST; 4795 South 3500 West, Roy)

The West Alternative would require the relocation of this business due to a take of about 2,762 square feet of this property. The amount of property acquired would be less than that for the Minimize 4(f) Impacts Alternative, but all other impacts would be the same as those from the Minimize 4(f) Impacts Alternative.

Dee's Service (UST, LUST, FINDS; 1793 North 2000 West, Clinton)

The West Alternative would require a strip take of about 1,241 square feet of this property. The amount of property acquired would be less than that for the Minimize 4(f) Impacts Alternative, but all other impacts would be the same as those from the Minimize 4(f) Impacts Alternative.

CH Dredge and Co. – Now SCI (LUST, UST, AST; 918 South 2000 West, Syracuse)

The West Alternative would require a strip take of about 12,494 square feet of this property. The impacts from this alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

Utah Onions, Inc. (UST, FINDS; 850 South 2000 West, Syracuse)

The West Alternative would require the relocation of this business due to a take of about 5,120 square feet of this property. The impacts from this alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

Midland Market – Now Sinclair Gas (UST; 3805 S. Midland Drive, West Haven)

The West Alternative would require a strip take of about 2,253 square feet of this property. The amount of property acquired would be less than that for the Minimize 4(f) Impacts Alternative, but all other impacts would be the same as those from the Minimize 4(f) Impacts Alternative.

4.15.3.2 Undocumented Sites

As described in Section 4.15.2.2, Undocumented Sites, three undocumented sites were found in the impact analysis area. The impacts to undocumented sites from the West Alternative would be the same as those from the Minimize 4(f) Impacts Alternative.

4.15.4 Mitigation Measures for Impacts to Hazardous Waste Sites

Measures will be implemented to prevent the spread of contamination and to limit worker exposure. Site investigations will determine the chemical hazard, if any, and the appropriate protective measures. In the case of an identified chemical hazard, the site remedy will be negotiated with the property owner prior to property acquisition and through the possible coordination with DERR.

Previously unidentified sites or contamination could be encountered during construction. In such a case, all work will stop in the area of the contamination according to UDOT Standard Specifications, and the contractor will consult with UDOT and DERR to determine the appropriate remedial measures. Hazardous wastes will be handled according to UDOT Standard Specifications and the requirements and regulations of DERR.

At the time of construction, coordination will take place between UDOT or DERR, the construction contractor, and the appropriate property owners. This coordination will involve determining the status of the sites of concern, identifying newly created sites, identifying the nature and extent of remaining contamination (if any), and minimizing the risk to all parties involved. Environmental site assessments will be conducted at the sites of concern to further evaluate the nature and extent of contamination and to better identify the potential risks of encountering hazardous waste when constructing the selected alternative.